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ABSTRACT

This practicum was designed to solve a problem related to the provision of a computer training component for students enrolled in an early childhood education teacher training program. Increasing pressures on graduates of the training program to integrate computers and educational software into programs for young children as well as the students' interest in developing computer skills specifically related to early childhood education made it necessary to design a computer training module which could be integrated into existing classroom hours in a tightly scheduled training program. Previous experience, skill levels, and goals with respect to computer training were surveyed. A module of computer training was designed by means of which much of the content would be addressed through independent study, assignments, and projects. A computer laboratory component was included to facilitate hands-on experience and the evaluation of educational software. The focus of the module was on the selection and integration of developmentally appropriate software into the regular curriculum for young children, in order to promote children's progress in the affective, cognitive, and physical domains. Included are the introduction, study of the problem, anticipated outcomes, evaluation instruments, solution strategy, results, conclusions, and recommendations. Appended are a copy of the survey, a list of professional development courses on computer literacy, the course outline, a computer literacy game, a computer field report assignment, a computer module outline, a computer literacy handout, a curriculum chart outline, an example of a student's diagram outlining classroom arrangement of learning centers, software evaluation forms, a module test, a module evaluation form, and an inventory of software for the early childhood education computer education module. (Author/KR)

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COMPUTER EDUCATION FOR TEACHERS OF YOUNG CHILDREN: A DEVELOPMENTALLY-BASED TRAINING MODULE

by

Dale Shipley

Cluster 28

Practicum Report II presented to the Ed.D. Program in
Early and Middle Childhood in Partial
Fulfillment of the Requirements for
the Degree of Doctor of Education.

NOVA UNIVERSITY

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Many persons have assisted with this project and the preparation of this Report. The writer wishes to acknowledge the enthusiasm, support and thoughtful feedback offered by the second year class of the Early Childhood Education Program. Without the students' participation and encouragement of my efforts the project would not have been as satisfying and enjoyable a pursuit as it has been. Marie Cormier, chairperson of the Department, has been generous with the financial support needed to purchase software. Jean Rolando, Departmental Administrator, negotiated the use of the computer laboratory for this module in spite of the pressure of demands from competing departments and programs. I am particularly appreciative of the thoughtful guidance, persistence and rigor demonstrated by my Adviser, Dr. June Delano. Her generosity with her time and expertise at each stage of the project have motivated and encouraged me to believe in its importance. Her enthusiasm for the project added to my own.

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ABSTRACT

Computer Education for Teachers of Young Children: A Developmentally-Based Training Module. Shipley, Dale, 1990. Practicum Report, Nova University, Ed.D. Program in Early and Middle Childhood. Descriptors: Teacher Education/Cognitive Development/Computer Uses in Education/Concept Formation/Problem Solving/Programming/Skill Development/Preschool Education/Primary Education/Perceptual Development/Piagetian Theory

This practicum was designed to solve a problem related to the provision of a computer training component for students enrolled in an early childhood education teacher training program. Increasing pressures on graduates of the training program to integrate computers and educational software into programs for young children as well as the students' interest in developing computer skills specifically related to early childhood education made it necessary to design a computer training module which could be integrated into existing classroom hours in a tightly-scheduled training program.

The writer surveyed the students in the training program in order to determine previous experience with computers, skill levels and goals with respect to computer training. The needs of employers and graduates of the program were also examined. Institutional support for timetabling and funding for the purchase of software and hardware for the training module were obtained. Three core courses taught by the writer were modified to accommodate a module of computer training within the time constraints and terminal performance objectives of each course. The writer designed a module of computer training in which much of the content of the module would be addressed through independent study, assignments and projects. A computer laboratory component was included in one course to facilitate hands-on experience and the evaluation of educational software. The focus of the module was on the selection and integration of developmentally-appropriate software into the regular curriculum for young children in order to promote children's progress in the affective, cognitive and physical domains.

The results of the practicum were positive. Student performance on the objectives of the module were tested and students achieved the prescribed standard. Students evaluated the module and made specific suggestions for its expansion and elaboration. Students expressed their satisfaction at having acquired a sufficient level of skill to be able to use computers as additional developmental tools to enhance play and learning within the preschool and kindergarten classroom.

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Chapter I INTRODUCTION

Description of Work Setting and Community

The setting where this project takes place is a large bilingual community college which serves approximately 60,000 part-time and 10,000 full-time students in French and English at five campuses covering four counties. The specific program referred to in this project is a two-year Early Childhood Education Program for high school graduates which offers a Diploma in Early Childhood Education and conforms to the guidelines and objectives established by the Provincial Ministry of Colleges and Universities. This Diploma is the qualification required by the Province for persons who plan to work in child care centres, nursery schools and other licenced programs for children between six weeks and 12 years of age. The Program resides in the Department of Family Studies which also includes seven other human services-related programs offered in English and French.

The Early Childhood Education Program was inaugurated in 1969 and since then has undergone two major revisions, the latest one occurring in the 1981-82 academic year. Since that time, the College has cut, by approximately 30%, the number of hours per week of instruction offered to students, although the terminal performance objectives and most of the courses have remained intact. In other words, the College has insisted that the Program must continue to meet the same objectives and fulfill at the least the same mandate but in a drastically-reduced time frame. Therefore, since 1982 courses and field work have become more streamlined. A greater burden of content and the practice of skills has been shifted from the classroom to the student who must acquire a larger share of the objectives through assignments, homework, independent study and practice teaching.

The Program consists of three main components, each of which assumes approximately one-third of the total number of hours allocated to the two-year training process. The three components are: field practice (practice teaching) in which students practice and master required skills outlined in the Ministry's Terminal Performance Objectives; core courses such as philosophy, terminology, design and planning of environments, curriculum and program planning, child development, child psychology, observation, legislation and community resources; and, resource courses such as health, nutrition, art and creativity, music and movement, children under stress, child and the family, administration and supervision, children's literature, and integration of the handicapped child.

The Program consists of two semesters per year over two years (four semesters), each semester of 15 weeks' duration at an average of 26 hours of instruction per week per semester including field practice time. Student enrollment in the Program reaches a maximum of 85 students in the fall semester of each year with 50 students enrolling in first year and about 35 students in second year. The attrition rate for the Program is about 30% which is within College guidelines.

The student population is predominantly females between the ages of 18 and 45 years of age, with the vast majority between 18 and 25 years. All students who are accepted into the Program must have successfully completed grade 12 of either a General or Academic high school program or have applied for admission as a mature applicant (over 19 years and one year out of school). About 25% of the students admitted each year have completed grade 13 and usually three or four of these also possess some university credits or a degree. A significant number of the students admitted have worked for at least one year after completing high school often in a child care situation. As the Program is in great demand, the College is able to offer places to about one applicant of every nine who apply. Selection is based on the ranked results of a language test, general knowledge and comprehension test using essay questions, work or volunteer experience in a related field and written references.

Writer's Work Setting and Role

The writer has been employed for nine years as a teaching master and coordinator of Early Childhood Education Programs at this College. The writer teaches five courses to first and second year students in the two-year program and two courses in the Intensive Program. The courses of particular interest to this project are described below:

Early Childhood Education I includes an introduction to early childhood education, philosophy of education, theoretical foundations, and formulation of a personal philosophy of early childhood education.

Early Childhood Education II includes management of children in groups, theory of play, environmental design and use of space for indoor and outdoor play, planning learning centers, activity planning and evaluation, and choosing equipment, materials and supplies.

Early Childhood Education III includes developmental curriculum planning to address cognitive, physical, language, and affective objectives. Subject areas such as language arts, science, number and creative arts are addressed within the developmental curriculum framework.

Early Childhood Education IV continues the developmental curriculum planning focus and also addresses physical curriculum, school-age curriculum, multiculturalism, and professional issues. Activity and program evaluation are also addressed.

The writer is responsible for the design and delivery of the above courses and is accountable for ensuring that the course objectives are met by students. The specific content, teaching strategies and evaluation instruments used are the writer's responsibility.

Chapter II. STUDY OF THE PROBLEM

Problem Description

Young children can benefit from exposure to a microcomputer in the early learning environment. It is important, however, that teachers of young children understand how to integrate computers into learning environments in developmentally-appropriate ways. Computers can become, under the guidance of a knowledgeable and skilled teacher, another tool for learning just as blocks, puzzles, lego, books, art supplies and other concrete learning materials promote learning and development in children. Teachers require training in the appropriate use of computers in the early childhood classroom. The Early Childhood Education Program in which the writer teaches does not offer a course or module of computer education to students training to be teachers of young children.

The problem was complicated by the fact that this training program is already strained in terms of the number of program hours allotted for teaching the existing Program objectives. The maximum number of student contact hours is 26 hours per week. The challenge involved finding a way to add computer training to the ECE Program without eliminating existing training components or creating additional strain on the program. It was important that the quality of training to meet the Program objectives not be jeopardized.

A component of computer education for students training to be teachers of young children had to meet the students at their own levels and provide them with training that will enable them to use computers effectively in early childhood programs. Therefore, a related problem to be solved was how to design a module which would, in a very few hours, provide students with sufficient expertise that they would be able to integrate computers successfully into programs and to choose software which is developmentally appropriate for children.

Dramatic social change, new training requirements from the workplace and technological developments have increased the pressure for change within the Early Childhood Education Program during a time of severe economic restraint, strict limitations to Program hours and high demand for qualified graduates. The training pressures from the community have mounted steadily during the past seven years as child care programs have had to address the greater needs of families and children. Higher quality care and educational programming to justify the high costs of care have been required to meet Ministry of Community and Social Services demands for better, more cost-effective service. Increasingly, too, child care services have had to compete with the public educational system which has continued to draw children away from child care and into the school system at earlier ages than previously.

The Program has felt the need in the past few years to introduce several new courses or modules and to make changes to some of the existing ones, specifically in the areas of child abuse legislation, children and stress and integrating children with special needs into regular programs. Since 1984, there have been some pressures to add a course on computers in early childhood education. Other colleges in the Province have inaugurated courses or modules to train students to integrate microcomputers and software into the educational program for young children. The writer's College has been slow to do the same, partly because pressures from the community have not been strong enough and also because there are no other courses in the Program which can be replaced or reduced. Faculty and management have held the view that the Program is spread as thinly as it can be in terms of providing sufficient hours to address the wide range of training objectives set by the Ministry. Another problem has been the absence of computer expertise among faculty attached to the ECE Program.

In recent years, new graduates and students in the Program have noted that this College is one of the ECE training programs in the Province not offering a course or module of computer instruction. The fear was that if a module were not developed soon, graduates of this Program would become less competitive and might lose jobs to others whose training might appear to be more up-to-date. The

College is at the same time undergoing a widespread computer revolution, as hundreds of computers are being purchased for departments across all four schools within the College. Faculty, management and support staff are being encouraged to take courses and become "computer literate". The time appeared ripe for the development of a computer module or course for the Early Childhood Education Program and to ensure that, in the technological area as well as in all others, our students continue to be competitive and in the vanguard of early childhood education expertise.

The problems to be overcome in adding a computer module have not vanished however. It remained impossible to add program hours over and above the 26 hour per semester maximum and to eliminate other essential courses. The challenge was to try to find a way to help students acquire sufficient computer expertise to remain competitive in the job market without jeopardizing the overall high quality of the training process at this College by spreading the content too thinly.

Assuming that some way could be found to add a component of computer training to the ECE Program, another significant problem to be solved involved making decisions about the type of computer training to offer to students in order to ensure that they have the skill they need to use computers in developmentally-appropriate ways. It was important to identify goals, objectives, teaching strategies, software, and evaluation systems for a training component which would give students the knowledge and skill they need to use computers with young children to enhance development.

By meeting these challenges, this ECE training program would provide computer education for students which would permit them to graduate with sufficient computer skill to be able to integrate a microcomputer and developmentally-appropriate software for children into the programs in which they would eventually be working. They would be able to shop wisely for hardware and software, integrate hardware and software into the physical environment of a program and into the curriculum, and use computers effectively with children. Students would be able to add basic computer skills to their repertoire of teaching skills which would enable them to continue to compete favorably with graduates of other programs. In acquiring these skills, students would enhance their own feelings of self-confidence as learners who are able to meet new challenges and master skills which they had previously thought to be beyond their reach.

Briefly stated, therefore, the problem to be solved was how to provide students in the Early Childhood Education Program at the writer's College with a module of computer education which would equip them to use computers and software as another developmental learning tool for children between the ages of approximately four and six years. Computer education would help graduates remain competitive and in the forefront of the field. A related problem was one of finding a time-efficent way of adding a component of computer instruction to the ECE Program which is already stretched to the limit.

Problem Documentation

Formal and informal evidence supported the existence of the problem. The writer conducted a survey of 90 first-year students enrolled in the Early Childhood Education Program. (Appendix A) Results of the survey showed that 76 students wanted to learn how to use a computer in order to do assignments and maintain files. Only 10 students had very little experience with computers and did not know how to turn a computer on and off and load software. Sixty-seven students indicated that they believed that microcomputers should be introduced to children in preschool and kindergarten. Seventy-three students expressed interest in having a module of training on computers in education included in the ECE Program.

Graduates have reported back to faculty through informal channels that they feel intimidated and insecure when they find employment in child care entres or preschools where children are encouraged to use the microcomputer. They have expressed interest in seeing a module or course of computer instruction added to the two-year ECE Program or a post-diploma course of computer training for graduates to fill what they perceive to be a gap in pre-service training. Faculty have also reported informally that students have expressed interest in learning to use computers in their field placements in order that they be able to acquire some knowledge and practical experience with computers before they graduate and enter the workplace.

The Early Childhood Education Advisory Committee, composed of community members and potential employers, has discussed informally in past years the advisability of adding a component of computer training in order that graduates be able to bring computer skills and new learning perspectives to preschool and school-age programs. The concerns expressed by representatives who sit on the Advisory Committee seemed to be based on a recognition that computers do not appear in programs for children in our community whereas they are being used in other communities in the Province. They attributed this lack of awareness and expertise to the absence of training in computer literacy for students in the pre-service training program. Some members of the Committee who are supervisors of child care centers or Ministry of Community and Social Services officials have expressed informally their belief that the ECE training program should show some leadership in the area of computer-based learning for young children.

The Ministry of Colleges and Universities has served notice that the ECE Terminal Performance Objectives which are the guidelines to be followed by all ECE training programs in the Province are to be revised in the near future. A committee of faculty has been appointed to coordinate the revisions. (Appendix B) It is likely that computer literacy skills will be added to the list of skills to be practiced and mastered within the pre-service training process.

The writer's College has been encouraging all programs to develop and implement computer literacy training components for students and has been providing professional development courses for faculty and managers in order to actively support and motivate progress in this area. (Appendix C) Department managers have been encouraging faculty to take the courses offered and have provided funding from their departmental budgets to purchase software to be used in the development of new training modules.

Articles in the local and national press have promoted the importance of computer training for teachers of young children and the advantages of computer learning in educational programs. The writer is quoted in a local newspaper as supporting the necessity for computer training within the pre-service ECE Program. (Appendix D)

Causative Analysis

Until very recently, that is, within the past three to four years, the literature in the area of computers in early childhood education has been ambivalent about the benefits versus possible hazards inherent in computer use by young children. Opponents of computer instruction for preschool teachers have been quick to cite negative reports in the literature about the possible ill effects of computers for young children. Arguments against their use have ranged from concerns about possible damage to eyesight, to interference with children's learning through play and experience in the concrete world, to inhibiting children's social development. More recent literature has argued convincingly that, when used appropriately by knowledgeable and skilled teachers, computers can be a useful and advantageous new tool to add to the preschool learning environment. It is more difficult now for opponents to muster arguments to detract from the advisability of providing some computer training to ECE students.

The Early Childhood Education community related to the writer's College has also been slow to incorporate computer technology into the child care programs in this region. In the absence of persistent demand from community employers for computer modules or courses within the pre-service training program, the College has hesitated to show initiative in this area and to fund requests for hardware, software and professional development for teachers. As the demand from the community for computer literacy and expertise in graduates has increased, the College has begun to respond with the necessary resources to enable all programs to meet growing need and community pressure.

Until the past three years, the College has not rushed to provide professional development in computer literacy for faculty. The cost of such training seemed prohibitive especially in the light of severe limitations on program hours which would not permit additional training components within programs for students. Recently, as a result of Ministry and community pressure as well as technological change, the College embarked upon a computer revolution. The College began urging departments, programs and faculty to develop new computer modules and courses. The time seemed ripe for the development of some form of computer training for the ECE program that would not diminish the overall quality of training according to Ministry guidelines.

Until recently, some ECE faculty have held negative attitudes toward the addition of computer training to the Program. Faced with external and internal pressures to introduce students to computers in order to keep pace with other programs and graduates, they became more supportive of a module or course that would not interfere with the mandated training addressed by the ECE training guidelines.

The quality of educational software for children has in the past adopted a prescriptive, programmed learning approach to drilling children in the memorization of facts and finding right answers. Software for children has been of the technological workbook variety. More recently, many software companies have been marketing software that is more developmental in that it focuses on helping children practice and acquire through play at the computer problem-solving skills, thinking skills, perceptual abilities and emergent reading and number concepts. The gradual appearance of more developmentally-appropriate software that relies on discovery-oriented play, problem-solving and creative thinking skills, has provided an added incentive for the inauguration of training modules for ECE students.

Another reason for some delay in the provision of computer training for ECE students has beem the absence of any clear consensus regarding the kind of training which would be most advantageous for teachers of young children. Some college ECE programs have experimented with standard computer literacy programs which have had no direct relationship to early childhood education and the use of microcomputers in early childhood learning environments. Very little documentation has been made available by teachers who have actually used computers successfully with young children. There have been few precedents to follow for the effective computer training of ECE students which would ensure that they use computers appropriately in early childhood classrooms.

The lack of pressure from students to introduce a computer module probably related to their somewhat negative perceptions of themselves as learners of new or difficult skills and knowledge. The typical population of ECE students consists of persons who have had some negative experiences in the school system and who have therefore tended to opt for the easier and more conventional subjects which they believe to be consistent with their aptitudes. Generally, ECE students are not willing risk-takers. Although many of them want to gain computer expertise, some believe that they are incapable of learning complex new skills and have therefore never chosen to take computer courses in high school. Many seem to want to learn about computers but are fearful that they might not succeed.

Relationship of the Problem to the Literature

Introduction

Seymour Papert's book, Mindstorms, (1980) stimulated debate about the viability of computer education for early childhood. His contentions that the child who programs the computer is engaged in active learning and that learning to communicate with computers affects the ways they learn other things stirred continuing controversy about whether early childhood is too soon for children to be exposed to computers. Questions have been asked about whether the procedural thinking required in programming computers is detrimental to the development of other kinds of thinking abilities. Doubts persist about whether the computer actually serves any educational purpose beyond those inherent in the concrete toys and objects from which children have traditionally learned and developed.

Turkle's book, **The Second Self: Computers and the Human Spirit** (1984) expanded the debate with its thesis that computers affect children's psychological development. Turkle outlined three stages that children pass through in their relationship to the computer which relate closely to their psychological development. Initially, in the metaphysical stage, children are mostly concerned about whether computers are alive and possess human characteristics such as the ability to cheat and feel. The second stage, at school-age, coincides with the middle childhood desire to win and is characterized by a need to master the computer in both games and programming contexts. The reflective stage occurs during adolescence when the child is able to successfully program in order to solve problems and take short cuts. Programming also provides the adolescent with a new way of finding out about himself as the computer program is often seen as a reflection of the programmer's mind. Turkle believes that computers change the way that children think just as different kinds of play produce different modes of thinking. Having questioned whether computers open children's minds or narrow their experiences making their thinking more linear than intuitive, Turkle concluded that computers open and enlarge children's thinking abilities and may even have a special role for women by making their entry into formal systems of science and mathematics more accessible.

Two ideas contained in Papert's book that have attracted widespread attention are that computers will bring about major cultural change and that this cultural change will cause "significant change in patterns of intellectual development". (Sullivan, 1985:3) Papert showed "clear preference for formal, analytical and syntactic modes of viewing intelligence" which are strengthened by the computer which is a formal, syntactic and analytic tool. (Sullivan, 1985:14) Sullivan concluded that it is important to consider the limits that computers may impose upon the mind and thinking processes and to question whether the computer nurtures the development of analytical left-brain thinking at the expense of right-brain intuitive modes.

Sullivan crystallized the central concerns about whether computer education promotes cognitive development by asking whether our culture's (and Papert's) bias to analytical and formal modes of thinking should be encouraged and whether the computer is biased to one cognitive style to the detriment of others.

> "We should be asking some of these hard questions...not to dampen enthusiasm, (but rather) to temper our enthusiasm in following an educational fad....As computers become a greater part of our educational environment, we must take the initiative to explore not only ecological questions dealing with health and safety but also the overall cognitive and moral functioning that is encouraged - or discouraged- by the presence of the computer in the educational environment." (Sullivan, 1985:14)

Ragsdale (1985) agreed with Sullivan that computers should not be introduced to classrooms uncritically but suggested that the summative methods currently used to evaluate the effectiveness of computer education should be replaced by formative methods which identify deficiencies in software and ways of correcting them and improving the~~ir~~ educational value. Hunka (1987) stated that in dealing with a new medium such as computers one must be especially alert to unanticipated outcomes and recommended goal-free evaluation which frees the observer to see what is rather than being blinded by prior knowledge of objectives.

This review of the literature will examine answers to the questions Sullivan raises and other viewpoints which describe how computers and software can be used effectively in early childhood education. The goal is to determine whether or not computers are an effective learning tool which teachers may use to enhance cognitive, physical and affective development in young children. Whether or not computers are developmentally useful learning tools for children, Ragsdale (1987) asserts that, given the omnipresence of computers in our society, the younger children are when they begin using computers, the fewer preoccupations they will have about them given that the role of the educational system is to provide children with a value base for their use.

Computers in Early Childhood Education: Bane or Benefit?

According to Coburn (1985), trying to explain a computer to someone unfamiliar with it is like the story of the six blind men who, each touching a different part of an elephant, believed it to be something different: a rope, spear, blanket, snake, tree, or wall. Computers can be instructional aids like movie projectors, blackboards, workbooks, drill exercise, thinking aids, calculators, Cuisenaire rods, typewriters, record keepers, information retrievers, communicating devices, instructors, toys, tools, files. (Coburn et al, 1985) All educational tools are value-neutral but can be used to "promote divergent thinking or conformity, freedom or restriction." (Burg, 1984:30) As with most other educational tools, the appropriate use of the microcomputer in the early childhood classroom depends to a large extent on the knowledge, creativity and thoughtfulness of the teacher who must learn to use it to benefit children. At present, few teachers have the necessary knowledge and expertise in the use of computers and have little time to develop it.

The fear that computers may have a limiting rather than a liberating influence on the development of children's thinking abilities has been a major theme of discussion about the pros and cons of computers in the early childhood classroom. Streibel (1984) analyzed claims of the cognitive-developmentalist perspective on the use of microcomputers in early childhood education and concluded that the algorithmic nature of computers and software might constrain rather than enhance children's cognitive development. Educators must ensure that they are not used exclusively as tools to promote knowledge- and skill-based learning in a behavioral science context. The temptation is to use computers to provide drill, repetition and rote learning since they accomplish programmed learning objectives by sequencing learning in bite-sized chunks, from simple to more complex, and by providing immediate feedback and reinforcement. According to Streibel, computers are biased against discovery and "quantum leap learning" which does not always follow the preordained series of sequenced steps typical of most software programs. The circumscribed, predefined structure of many software programs may produce in children a corresponding predefined structure of thought, rather than facilitating development of the ability to "create structure and meaning simultaneously under the real-time guidance of a human being". (Streibel,1984:14) Although computers can be useful for skill-training and knowledge acquisition, skill-training must be subordinated to "people making" in early childhood education. (Streibel, 1984:18)

Elkind's concern about the introduction of computers into early childhood education is a component of his more general concern that modern society has evolved a false image of the child which fits in with the prevailing needs and concerns of adult society just as most generations in the past have done. He claims that today as in the past, child-rearing and education is determined by a "complex of social, economic and cultural factors that may have had little or nothing to do with the natural child". (Elkind,1987:7) He sees computers as boring teaching machines which present programmed learning which risk turning children off computers before they have begun to understand their usefulness and believes that the computer's technological sophistication is beyond the cognitive capabilities of a young child. Elkind equates introducing young children to computers to addressing with them the threat of nuclear war and the dangers of AIDS. He seems to miss the point altogether that the ability to use a computer for games, learning activities or even basic programming is just another medium of communication through which children are able to experience active interaction with concrete objects in the environment. They do not have to understand the complexity of hardware design and the electronic engineering involved in the microchip. Being able to conceptualize nuclear weapons and holocaust and the awesome human consequences of AIDS and its social origins requires abstract thinking abilities far beyond the capabilities of young children not to mention the inappropriateness of frightening young children about things which they can do nothing about at their stage in life. Although Elkind generally exhibits very sound judgment, he fails in his discussion of computers and early childhood education to account for the educational usefulness of computers beyond direct teaching and programmed learning and incorrectly categorizes their use with many other educational misapplications which lead to the miseducation of children.

Siann and Macleod (1986) reported that their studies of the effects of computer use by Scottish children ages five to seven and eight to eleven have not documented the general cognitive gains claimed by many American studies. They agreed however with Papert's claim that using LOGO to program can lead to a broader range and more spontaneous uses of the computer such as scribbling, writing, doodling and doing assignments. When the computer becomes "transparent" in the sense that it is used by children as a resource, it becomes a most educationally viable tool to enhance the learning process. (Siann & Macleod,1986)

Shade (1985) concluded that many computer applications are developmentally appropriate for young children. His argument is based largely on Bruner's belief that there are external as well as internal influences on cognitive development and that the external influences are largely cultural. (Bruner, 1973) The more complex a culture becomes, the greater the need to rely on sophisticated tools which will facilitate the child's acquisition of the skills, knowledge, attitudes and concepts that the child needs to become a competent member of society. Shade suggested that educators can therefore not afford to neglect the powerful potential of the computer in helping children acquire necessary competencies in the short time available to them.

Computers facilitate children's development in many ways. (Shade, 1985) They combine visual, auditory and kinetic feedback simultaneously, thereby strengthening the child's natural motivation to learn. Children often respond more readily to working with concepts on the computer than to traditional teaching methods and are naturally attracted to the computer. Computers strengthen children's awareness that actions have consequences especially when they learn to draw using a screen or a floor turtle. Computers can also enhance children's abilities to discover original associations between objects and events, to find hidden processes in programs which may affect outcomes, and to discern discrepancies between objects and events. Specially-designed software has the potential to promote exploratory and discovery-oriented behavior which could counterbalance the algorithmic uses most associated with computer activity.

Beaty and Tucker (1987) argue that the computer in the classroom equalizes opportunities for all children. In their Elmira College project they demonstrated that computer activity benefits the shy child who does not respond well to group activities, as well as the quiet, passive child who may shine at computer activity and emerge as a leader in computer proficiency.

The minority child who can be encouraged to develop computer skills also stands to gain in popularity with other children who are able to learn from him.

Simon (1985) has found considerable evidence that as long as the microcomputer is not disruptive to normal classroom activity, it should, if correctly used by teachers, serve to enrich the child's environment. Nelson, Killian and Byrd (1988) documented what happens when preschool children are able to work and play with a computer in a university-based preschool. They asked questions about the computer's social effects, educational effects and cognitive implications for young children and found the computer to be a responsive tool which could be used in a variety of ways. While not all children expressed the same willingness or desire to use it, eventually all children tried it and evolved their own system for using it in the classroom. The importance of respecting individual differences in the use of the computer was emphasized. These researchers concluded that the computer can be, in the hands of a competent teacher who is comfortable with the computer, a new mode of communication and expression that has the potential to be especially useful for individual children, that provides appropriate cognitive challenges, and may encourage discussion, construction of new knowledge and understandings and mutual encouragement and reinforcement amongst children.

The Relationship between Computers and Child Development

Turkle (1984) emphasized the computer's effect on children's psychological development as they ponder metaphysical questions relating to where the computer stands in the world of nature and of artifact, as they compete with the computer to win and gain mastery in games and programming, and later, as they explore the patterns of their own thought processes by designing and testing their own computer programs.

Burg (1984) acknowledged that the computer can provide children with developmentally-appropriate experiences that stimulate divergent thinking and lead to creativity as well as language, problem-solving, pre-math and pre-reading skills. Perceptual skills such as visual recognition and discrimination, spatial concepts, part-whole and figure-ground relationships, and auditory skills, are well-adapted to educational software. Fine motor skills are practiced when children color, draw, or play games using a joystick. The computer can promote autonomy by encouraging children to choose from a variety of alternatives and make their own decisions. It also fosters self-esteem when children are reinforced for their mastery of the computer, and encourages cooperation as they learn to share information and ideas, take turns and help one another solve problems presented by the software. The computer is most effective as a tool to facilitate development when teachers who know the developmental needs and capabilities of their own children also possess the knowledge and experience to tailor computer activities and challenges to individual needs. Burg therefore advocated teacher learning of basic programming techniques rather than reliance on commercial software.

Anselmo and Zinck (1987) examined the developmental usefulness of popular software designed for early childhood education programs. They assumed that children needed a broad background of concrete experiences in order for more abstract computer experiences to be meaningful and developmentally advantageous. Their examination focused on software to enhance children's thinking skills in comprehension, memory, evaluation and creativity. They found several software programs that promote development of visual closure and visual tracking skills which are important to reading and others which promote memory, decision-making, classification, estimation, matching, conservation and ability to plan. Software to promote these skills should be used only as a supplement to the concrete, sensory and social activities normally found in the early childhood classroom. Their observations of children using computers led them to four general conclusions that computers can be socially interactive, that the age of children is relevant to the success children experience with computers, that children prefer to be active with computers and other activities, and that computers play a role in encouraging nonreaders to read.

Anselmo and Zinck also found that interest in computers increases from virtual absence at age three to moderate interest by fours and enthusiastic involvement by kindergarten and early primary children. These age-related differences were attributed to cognitive changes during the preoperational period as the child moves from dependence on perceptually-based, concrete experience to a gradual ability to employ symbols and mental representations instead of the actual thing or event. They agreed with Papert's suggestion (1980) that computers may even be useful aids to children's transition from dependence on the perceptual and concrete to the development of concepts and symbolic and representational abilities. They also suggested a possible link between the three-year-old's lack of interest in computers and their dependence on teacher presence, given that computers are usually used independently by children without much teacher involvement.

Piel and Baller (1986) conducted a study of 44 preschoolers ages two, three and four, to determine whether computer-assisted instruction could enhance performance on Piagetian classification and conservation tasks. Both the ages of the children and the amount of exposure to computers proved to be significant variables. The study showed that using a computer facilitated the transfer of concepts from the computer to a clinical testing situation even for the two-year-olds. They concluded that amount of time spent on the computer tasks as well as the type of software material used likely made the difference. Piel and Baller also speculated that computer exposure may positively influence attention span and ability to overcome obstacles and complete the learning task, which also affects final outcomes.

Their conclusions raised questions about whether computers contribute to increased motivation and produce children who are ready for conceptual tasks at earlier-than-usual ages.

McGarvey (1986) found that computers in the kindergarten classroom facilitated the acquisition of school readiness skills and that when the children had access to complementary computer activities at home, their academic gains were even greater. No evidence was found that computers interfere with normal preschool cognitive development or that there were any gender-related differences in cognitive gains.

Riel (1985) reported on the implementation of a computer curriculum for early primary children called Mental Gym and the implementation of a Computer Chronicles Newswire and found that the computer presents new possibilities for cooperation and social interaction rather than limitations. The computer appeared to give children more control over their learning environment particularly when they learned how to make the computer serve their own purposes. The children's newswire service also resulted in gains in low-achieving students' reading and writing skills as well as gains in their reporting and editing skill which she attributed to children's greater confidence as they gained a sense of control over the computer and a purpose for writing. Hungate's study (1982) on younger children in kindergarten demonstrated that computer activities promote reading readiness and facilitate general learning competence. Strein and Kachman (1984) advocated caution in assuming that computer software can engage children in cooperative tasks, admonishing teachers to critically evaluate software for young children until the necessary liaison between educators and software entrepreneurs is much better established.

Johnson (1985) studied the characteristics of 25 preschoolers interested in computers who were classified by their teachers as highly-involved, moderately-involved and little-involved. He found that highly-involved computer users tended to be older children, were equally likely to be a boy or a girl, and that they exhibited significantly higher levels of cognitive maturity than children who were designated as little-involved. High users also demonstrated higher levels of representational competence, and more organized, more focused and less concrete forms of free play behavior than low users. Teachers reported that low users regularly engaged in more concrete play activities than high users. Johnson concluded that there is a significant relationship between stages of cognitive development and computer use by preschoolers.

It is useful to compare Johnson's conclusions with those of Barnes and Hill (1983) who claimed that children are only able to engage in meaningful involvement with computers when they have attained concrete operations which usually occurs after the age of six. The Johnson study also suggested that there may be a relationship between compatible play style and computer involvement. Teachers observed that high users demonstrated greater tendency to play with one toy at a time in an ordered fashion than low users. Johnson postulated a possible link between "patterners" (Wolfe and Gardner,1979) and high computer use, and between "dramatists" and low computer use. Brady and Hill (1984) also suggested that there may be personality characteristics which cause some children to seek out and benefit from computer usage.

Klein (1988) conducted a study to ascertain developmental differences in children's feelings toward computers through clinical interviews and examinations of children's drawings of computers. Results showed that the youngest subjects, three to three-and-a-half years old, were confused and anxious about computers and showed a significant drop in the level of organization and quality of their drawings when required to deal with a computer. Past experience with computers did not seem to have an effect on this group. By the time children experienced with computers reached four-and-a-half to five years of age, Klein noted a more relaxed, less confused and more positive approach to work with computers although there had been no significant difference noted for the younger four's. The older group of five- to six-year-olds seemed to react positively to successful experiences with computers which influenced their feelings about them. Klein concluded that questions may be asked about whether or not it is wise to expose three's to computers at all. Results suggest that four's and five's can likely sustain some gentle introduction to them as their curiosity and interest is aroused and providing that their experiences are successful.

In all cases, Klein's research conclusions underline the importance of dealing effectively with the child's first encounters with the computer and the importance of accounting for age, sex, experience and successes with computers as significant variables in facilitating a match between children and computers in the learning environment.

Computers and Creativity

Creativity has been defined as the ability to engage in divergent thinking in a variety of contexts. Divergent thinking is the ability to generate many solutions to problems and to make connections and relationships amongst ideas or things that are unrelated in a conventional sense. Given the algorithmic nature of most computer activity, educators have long been doubtful about the usefulness of computers as instruments to facilitate the development of creativity. Typically, they have been viewed as tools to promote convergent thinking and linear patterns of thought rather than originality and novel solutions to problems. A literature on the relationship between computers and creativity is growing rapidly. It suggests that educators need to take a second look at the potential of computers in early childhood classrooms to facilitate the development of divergent thinking skills as well as more conventional creative abilities such as symbolic and representational abilities, graphic and artistic skills. However, it is difficult to find research which proves that the computer facilitates creativity over and above the everyday living experiences of childhood.

Tisone and Wismar (1985) believe that used in conjunction with creative teachers, computers possess many characteristics which may promote creativity. They cited menu selection as one example; it allows children to choose programs that appeal to them thereby increasing their freedom and motivation to learn. The branching into new questions and learning areas which is built into many software programs keeps the child involved in the learning activity and promotes cognitive processing skills which are related to creativity. Programmed feedback urges the child to branch to other sections of the software package which may provide hints or a review of what has already been presented. Therefore, the child learns that there are usually alternate routes that may be pursued in problem-solving as well as ways of overcoming obstacles in order to realize a plan or complete a task. The networking and interactive imperatives of many software programs for children encourage them to seek out and rely on other resources and people in order to find answers and generate new ideas. Children soon realize that they are able to try various solutions to problems or tasks presented by computer programs without being penalized or losing face; this reinforces their understanding that one learns from one's mistakes and that trying again is important. Also, when children are encouraged to engage in debriefing activities and stimulating discussion with their teacher after using computer software, the creative potential of computers is enhanced.

Steffin (1983) proposed that the computer is a potentially effective weapon against the tendency toward convergent thinking which permeates too many early childhood classrooms. He saw the computer's attributes of interactivity, immediate feedback, variability in presentation, neutrality of response, and privacy as important elements which make the computer a powerful tool in promoting divergent thinking. Anselmo and Zinck (1987) argued that creativity is the developmental ability which the computer most enhances. Programming experience encourages children to be active participants in their own learning and wordprocessing software permits children to record their stories and poems. Burg (1984) saw creative potential in software which encourages children to solve problems such as, "how many different ways can you...?", "how many ways can you show...?", and "how many different ways can the dog go from his house to the tree?" When children think up new content for computer games they have mastered and design completely new games they are also engaged in important creative thinking tasks.

Computer drawing programs are viewed positively by Alexander (1983) as they generally capture and hold children's attention and appeal to children of all developmental levels even as young as three years. He believes that if the opportunity is presented, children will choose the computer as a creative medium as readily as they will choose other creative media such as sand, water, concrete graphic materials and blocks.

Beaty and Tucker (1987) highlighted the link between visual thinking and creativity. Computer software for children matches their development by presenting concepts nonverbally using color graphics. Creativity appears to be connected to the ability to "create images in the mind's eye" or visual thinking. (Beaty & Tucker,1987:9) Young children think more easily with images than words during the years before their verbal skills are highly developed. By seven or eight years much of the creativity which arises from children's visual thinking abilities has diminished while their verbal thinking has increased and the definition of the two hemispheres of the brain has been clarified. As the functioning of the left brain which controls verbal and abstract thought increases in importance, the visual thinking of the right hemisphere becomes less useful and loses its impact. It is at this stage that researchers in creativity and teachers of young children have seen a corresponding dramatic decrease in the child's creative abilities. (Gardner, 1980)

Beaty and Tucker (1987) reported that Kim (1985), author of the book **Inversions**, MIT Press, believes that "computers are the answer to getting visual thinking recognized". (Beaty and Tucker, 1987:11) Kim's point is that continued computer activity which involves visual thinking may foster the preservation of young children's active visual imaginations long after they have also developed their verbal skills. Beaty and Tucker maintain that given this possibility, computer use should start in preschool with software selected for its strong visual appeal and continue into the elementary and secondary levels.

Computers in Special Education

Computers are a valuable resource for the education of children with special needs. Computers function as "tools, tutors and tutees" in classrooms for exceptional children as well as regular classrooms. (Brady and Hill, 1984) In a study conducted in Israel, "headmasters evaluated memory, arithmetic, reading, concentration, and perception as the most important skills for children with special needs which are likely to be enhanced by microcomputers". (Malka and Schulman, 1986:203) The researchers claimed that the introduction of computers into special education restores the credibility of cognitive skills training. Special educators have observed high motivation and improved levels of personal integration in handicapped children who work or play with the computer and often appear to be "new children".

Experts seem unanimous on the positive, far-reaching effects of computer education for handicapped children. Burg (1984) reported significant gains directly related to their involvement with a computer in the classroom made by children who experienced language delays, fine motor immaturity and social problems. Behrmann and Levy (1986) state that the introduction of the computer into special education may be the most important improvement in the education of the handicapped since the implementation of the law integrating handicapped children into their communities (PL 94-142 1975). They have found that computers and carefully selected software have the potential to take the handicap out of many disabilities by accommodating to the handicap of the child and permitting children to perform certain tasks and operations independently. Opportunities for language and communication are greatly enhanced by voice synthesizers and wordprocessors and the physically disabled child may use a computer to turn on the television, answer the phone or perform other simple tasks which were previously inaccessible. Hutinger (1987) agrees that the computer has meant a significant breakthrough in special education in which the goals are to help the child become increasingly autonomous, to learn to control the environment, to communicate, to program and problem-solve and to engage in academic learning. She adds that the nonthreatening presence of the computer which gives immediate feedback and is infinitely patient contributes to the child's emotional security and psychological comfort with learning tasks. The handicapped child also experiences a sense of control which is unique and valuable. Even with the countless advantages available to handicapped children who have access to computer education, the major stumbling block to their widespread use is the inexperience and inadequate training of teachers in computer education and programming. Hutinger calls for new teacher training approaches for students in early childhood education, developmentally-handicapped and child care training programs which will adequately prepare graduates to implement computer education with handicapped children in integrated and segregated settings.

Is Play with Computers Really Play?

Early childhood educators agree that the appropriate learning environment for young children is one that emphasizes learning through play, where play activities which address developmental objectives form the backbone of the program. Concerns about the viability of the microcomputer as a tool for learning in early childhood often revolve around the question of whether or not playing with computers is really play. A study reported by Simon (1985) conducted by Fein, Campbell and Schwartz (1983) examined children's perceptions of play and work. The five-to-nine-year-olds characterized play as something that is done with things, that is related to external goals, rewards or other externally judged performance criteria, and usually done with peers. Work was perceived to be obligatory, required doing things which had external goals, rewards and performance criteria, and usually done with adults.

Fein, Campbell and Schwartz concluded that computer play with drawing programs and Papert's LOGO microworld fit these children's definitions of play. Their definitions also seemed compatible with Dewey's belief that play is any productive and satisfying enterprise that does not deteriorate into random, purposeless fooling around. (Simon, 1985) One may conclude that play with computers, that is oriented to children's needs and capabilities, using software that is carefully selected or designed by a teacher who knows the children's developmental levels, would fit some accepted definitions of play. Computer science literature agrees that computers should first and foremost be presented to children as learning tools which are fun. (Kimmel, 1981)

Implementation of the Microcomputer in Early Childhood Classrooms

Neilsen (1986) argues that working with computer software and learning to program demands considerable teaching and human interaction and is therefore not a challenge which the computer in the home or the regular classroom can currently meet. But for teachers willing to try, one of the first tasks confronting teachers who introduce the computer to their classrooms involves choosing the strategies which will lead to effective use of computers by young children. Teachers need to choose strategies and uses for the computer initially which reflect the knowledge and experience that they have been able to gain to that point and then resolve to continue their independent learning and to learn along with the children. An important prerequisite to effective use of computers in early childhood education is the understanding that they are versatile tools which should be used to enhance development rather than to structure learning.

Some programs provide several computers in a designated room for scheduled use by groups or classes of children. Others install one computer in a special computer learning center to be used by children individually or in small groups as they would choose the equipment available in any other learning center. Questions such as should computer learning take place in the home, the school or in specially-designed programs, and for how long should children use the computer at one sitting inevitably arise when teachers begin the task of thinking through their most appropriate use for their children. (Brady and Hill, 1984) The best thing a teacher can do is to "invent the approach that best facilitates the learning of the knowledge to be taught....The teacher must intuitively understand the knowledge to be taught from the perspective of the child to be taught".(Hoffman, 1986:181) If one assumes that learning occurs through one's interaction with one's environment, then the role of the teacher becomes one of modifying the environment in order to "optimize the probability of certain environmental interactions". (Hofmann, 1986:181)

Several research studies agree that pairs of students at a computer is an optimal learning situation. (Dickson, Patrick, Vereen, 1983; Davidson, 1989) Opportunities to verbalize learned material and to explain lead to cognitive restructuring by the child doing the explaining. (Webb, 1982) When pairs of children work at a computer, turn-taking and games for two players become the normal practice. With three or more children, turn-taking is less successful and team approaches with each participant playing a special role seem to work more effectively. Certain software encourages children to cooperate on solving puzzles and to reach consensus, perhaps by voting, before the next key is pressed. Learning results from discussion amongst the children intended to clarify the principles of the activity. Another strategy for groups of three is to have one child assume responsibility for operating the keyboard or joystick while the remaining pair cooperate in solving the puzzle or playing the game. (Dickson et al, 1983) In multicultural classrooms there are many advantages to having pairs and triads composed of minority and non-minority children and to assign cross-sex pairs to work together in order to foster cooperation and understanding. Slavin (1980) reported that children frequently identified "friends" of other races when they were involved in cooperative learning activities.

Beaty and Tucker (1987) recommended that the computer be placed in a sectioned-off, low traffic area, against a wall and away from direct sunlight. As many computer activities require concentration, the computer should be located in an area where distractions can be minimized. Computer monitors are better than television screens which cause greater eyestrain and potential hazards from radiation. It is important to the development of self-confidence that children be permitted to operate and control both the hardware and software, but a few rules for their use must be established and consistently enforced. There should be three essential rules: no liquids or food in the computer area; use only your computer finger; and, come to the computer with clean hands. (Beaty & Tucker, 1987:21)

The question of how to introduce the computer to children in the early childhood classroom has been addressed by Galen (1985). She concluded that the provision of an initial classroom instructional phase on how to use the computer, its possibilities, the software choices, and basic information about the hardware has advantages over merely hands-on, discovery-learning with no preparatory instruction. Ball (1985) concluded that computer use with kindergarten and early primary children should take advantage of the powerful interactive nature of the computer, consider the child's readiness, and not require sophisticated keyboarding skills.

Gender-Related Differences in Children's Computer Use

Generally, studies of gender differences do not show boys dominating the computer or becoming more expert on it than girls. (Beaty and Tucker, 1987) Lipinski (1984) reported that girls in her study spent significantly more time at the computer than the boys and concluded that it is likely important to introduce children to computers before sex-stereotyping regarding computers sets in. Beaty and Tucker (1987) found in the Elmira College Project that girls and boys showed equal interest and spent equal time at the computer. They agreed with Turkle that computers represent a medium by which girls can gain confidence in their math skills and that it is because the computer can be "negotiated with, responded to...and psychologized" that it offers girls a more interactive and intuitive entry to formal systems. (Turkle,1984:84) Computers also provide for boys who resist other language and fine motor activities a unique opportunity to improve verbal and fine motor skills.

Siann and Macleod (1986) argued in favor of using computers to facilitate female introduction to technology and formal systems. A recent Manchester study, as well as their own Scottish study, showed that even at the age of eleven there are substantial gender differences in levels of interest in science and technology and that girls are tending to self-select themselves away from computer technology in primary school as early as six and seven years of age. In another study, 158 nursery and primary children responded that they thought boys would like computers more than girls would. They concluded that it is important to use computers in primary school to diminish gender differences in perception and use of computers. Building on Turkle's findings, Siann & Macleod proposed that there should be changes in the content of software to include content which has more appeal for girls and more opportunity for incorporation of fantasy and creativity. Computer use should also be integrated into curriculum areas such as creative and language arts. The composition of groups in which computers are introduced may be another way to reduce gender differences in their use. Computers should be introduced to single-sex groups, and in the case of girls, by a female teacher. (Siann & Macleod, 1986:143)

Strategies for using computers should promote the facilitation of greater educational opportunity for all. "Democratic ends, not fashion, not technical analysis, not market forces, should control the use of computers. Knowledge ought to bring us greater flexibility and freedom, not new forms of subordination." (Olson & Sullivan, 1987:104)

Choosing Developmentally-Appropriate Software

Kuschner (1986) concluded from his study with five-year-olds that good software should encourage the child to exercise his intentions, reflect on the results of his actions, and permit him to revise his intentions and actions. Some software contains built-in possibilities of conflict as a result of the software's inability to execute a child's conceptual plan. Teachers have to examine software carefully before presenting it to children in order to minimize the potential for conflict which detracts from successful and positive experiences at the computer. (Burns, Goin and Donlon, 1990)

Grover (1986) studied whether or not software using cognitive-developmental principles would result in more effective learning for young children than software which did not incorporate such principles. She concluded that software should incorporate cognitive-developmental principles and that no-voice versions of software are more effective than the same programs when a voice synthesizer is added. Some questions were raised about whether assignment of specific computer tasks produced better gains by children than open-ended approaches whereby children were able to choose a computer activity in the computer learning center. It was found that that the more important determinant of success lies in software design. The graphics displays, cueing, nature of the feedback, the reinforcers provided, and other design components should all be designed according to cognitive-developmental principles.

Hofmann (1986) assumed that the teacher will be well-grounded in Piagetian theory as a pre-condition to using the computer as a teaching tool with young children. It is important that the software assume the role of teacher and the software, like the teacher, must be flexible enough to accommodate incorrect responses. Feedback should vary according to the unique properties of the learner's response and also permit the child to correct or revise his response, before as well as after the evaluation of his first response. The software content should be sequenced from simple to more complex with each step in the activity building upon previous learning gained from the software environment.

Lewin (1981) suggested that the first rule in software selection is that it be easy to access and use with clearly defined content which promotes positive values. The same selection criteria should be applied to software as to television programs for children; violent and mindless content should be avoided. Aesthetic quality greatly affects the overall appeal of software for children and should be an important criterion in its selection just as it is for children's books.

Using the LOGO Microworld as a Vehicle for Development

Papert's definition of a microworld has been interpreted as "... an open-ended, user-designable, child-oriented software experience where children have direct access to specific concepts and the ability to exercise these concepts in meaningful ways".(Shade,1985:204) Shade saw the design of microworlds such as Papert's LOGO microworld as a way of maximizing children's exploratory behavior with computers. He argued that the computer maximizes the child's actions by allowing him to combine visual, auditory and kinetic feedback simultaneously which strengthens the child's natural motivation to learn.

The popularity of the LOGO microworld demands that some attention be paid to the vast amount of literature which examines its intent and the discernible effects it has on children's development. Brady and Hill (1984) reported that much of the earlier literature revealed a need for a more complete understanding of LOGO and its value with children. Considerable variation found in children's abilities to use LOGO caused them to conclude that children first need to master skills that would allow them sufficient control over the computer. Questions were raised about prerequisites to the effective use of LOGO by children: what skills are prerequisites for learning to program; to what extent are young children capable of the linear, sequential thinking required by programming; does using LOGO enhance children's problem-solving and/or creative skills; what sense of personal contact do children gain from designing a program; and, are programmable, three-dimensional toys such as Big Trak and robots more appropriate for young children than hardware that uses more abstraction? (Brady & Hill, 1984:52)

Several studies indicated a strong relationship between the child's level of cognitive development and ability to profit from

LOGO instruction. (de Bernard, 1986; Hines, 1983; Brett, 1983; Krasnor and Mitterer, 1983) Papert's Piagetian orientation led him to make the elaborate claim that since children learn without being taught, therefore, if children use a computer to draw houses or flowers they automatically learn the basic rules of geometry and generalize from LOGO to better problem-solving skills. Gorman and Bourne (1983) found little evidence that thinking is enhanced by LOGO experience although they detected a slight improvement in performance on rule-learning tasks. Hines found an enormous amount of variation in the way young children learn problem-solving skills through LOGO. (Simon,1985) Krasnor and Mitterer (1983) concluded that LOGO likely does not facilitate general problem-solving skills although for children whose logical operations are sufficiently developed to permit them to appreciate the structured programming aspect of LOGO, it may prove beneficial to the development of specific problem-solving skills. (Simon, 1985) Simon concluded from his own research that LOGO may help children integrate abstract concepts but the question still remains whether LOGO demands prerequisite logical thinking skills and whether it will foster the growth of logical thought.

Howell, Scott and Diamond (1987) investigated whether or not Instant LOGO contributes to the rate of cognitive growth in kindergarten children and concluded that there is no evidence that it does. They concluded that more research is needed on the quantifiable and non-quantifable cognitive impacts of LOGO and

Instant LOGO that include general cognitive and academic skills. They suggested that perhaps the effects of LOGO cannot be measured accurately in the usual ways at least with young children, and also that LOGO may affect specific academic behaviors in the short-term while general cognitive gains require much more time and practice.

Tan's (1985) more optimistic view of the value of LOGO instruction with young children supported the suggestions of Howell et al (1987) that 'soft' gains may be more significant than the 'hard' gains. She claimed that children acquire not only skills such as concepts of direction, distance and angles, but also desirable attitudes toward computers, the ability to formulate and execute plans, and ability to build up elements into more complex operations. Children's interest and abilities with LOGO seem to vary as they do in the context of all other media and we should not expect it to appeal to all children in the same way.

Papert's claim that LOGO permits children to take control of their own learning processes has been investigated by Emihovich and Miller (1986) who argued that teachers must facilitate children's internalization of abstract concepts by modelling the strategies children need in order to think through LOGO tasks. Their study examined how teacher modelling of strategies facilitated five-year-old children's cogitive development from external regulation to self-regulation. The results indicated that as children gained greater mastery their language became increasingly task-oriented, seeking help or guidance decreased, and teacher directives decreased as peer collaboration increased. They concluded that careful structuring of the teaching process may be required in order for children to learn LOGO successfully. This finding also reinforced the important role of the teacher in computer use for early childhood education.

Clements and Gullo (1984) studied the effects of LOGO computer programming on a small sample six-year-old children's cognitive style, specifically reflectivity and divergent thinking, metacognitive abilities, overall cognitive development and ability to describe directions. Comparisons were made between two groups of children who were randomly assigned to either a computer-assisted instruction group (CAI) or a computer programming (LOGO) group. It was found that the LOGO group received significantly different scores on the pre- and post-tests of the Torrance Tests of Creative Thinking of fluency, originality and divergent thinking while the CAI group showed no significant differences. The LOGO group also significantly outperformed the CAI group on the metacognition tasks presented. However, no significant differences were reported between the groups on operational competence (classification and seriation). Clements and Gullo concluded from this small study that programming experience may affect cognitive style but there is no evidence from their study that it affects general cognitive development.

Clements (1986) concluded from more research on the cognitive impact of LOGO in the early years that more research is needed to determine the factors which lead to success in learning programming and speculated that there are likely many variables. He saw some evidence that programming can raise scores on tests of rule learning, ability to reflect, creativity and metacognitive ability in younger children. He also suspected some postive effects in the area of prosocial interactions. Generally, however, Clements found that more research which includes the wider educational environment, the nature of the learner and pedagogical approaches is needed to determine whether or not LOGO programming has any affect on children's academic achievement.

Conclusions Based on the Literature

This review of the literature has investigated several issues related to the effectiveness of computers as learning tools which teachers may use to enhance cognitive, physical and affective development in early childhood.

Evidence examined indicates that by far the most convincing arguments may be found that computers, when used appropriately by knowledgeable teachers, influence development positively in all developmental domains. Whether or not they have a liberating or limiting effect on thinking abilities is as yet uncertain. Many studies have been conducted to examine Papert's claim that computer programming with LOGO does alter and enhance cognitive thinking styles but the results are inconclusive and suggest that more research is needed. Certainly the evidence is overwhelming that when used judiciously by trained teachers, computers can be much more than the programmed learning instruments feared by Streibel and Elkind. A key element in the success of computers as tools for development is the choice of software which must be carefully designed according to cognitive-developmental principles. Many studies confirm that all aspects of software design are important for developmental progress to occur and specific selection criteria should be applied systematically when evaluating software for young children. It is also clear from the research examined that successful implementation of computers in classrooms depends on their planned introduction into the environment and capitalizing on their interactive nature.

Researchers seem to be in unanimous agreement that computers are an excellent learning tool for handicapped children in integrated and segregated environments and are responsible for a major breakthrough in special education. Fears that computers endanger the play element essential to successful early childhood education are allayed by studies showing that computer play conforms to children's notions of play as well as to criteria established by notable play experts.

Studies on the relationship between computers and the development of creativity in children are particularly interesting and concur with much of the literature on creativity which shows sharp decline in children's creativity as verbal activity and reading become more dominant in their lives. Research showing the computer as a right-brain tool which promotes visual thinking may indicate that computer activity may prolong children's adhererce to visual thinking skills while simultaneously acquiring left-brain language and reading skills.

All evidence seems to suggest that early childhood educators should continue to become informed and competent users of computer technology in the classroom. They should also refrain from making undue claims and anticipating extravagant changes in early childhood education and in children's development as a result of using computers in the classroom. Plenty of evidence supports the computer's usefulness as an educational tool which will stimulate development when used effectively and thoughtfully by informed teachers. Computers seem to be effective tools to help children visualize concepts and may bridge gaps between the concrete and abstract elements of concepts which sometimes delay the acquisition of conceptual understanding. Computers also seem to help children learn to think and engage in metacognitive processes. (Wacksmith and Becker, 1986) The important role of the teacher in the implementation of computers in early childhood classrooms is indisputable. The future of computers in early childhood education depends largely on the continued professional development of teachers in the area of computer learning.

Teachers of young children are being wise and responsible when they are cautious about unproven tools and trends. But computers are amazing inventions and worthy of all the time and energy spent learning about their potential in classrooms and studying their potential pitfalls. They have become an important part of our culture and teachers must not be deterred in their efforts to find a suitable place for them in the learning environments they design for young children. Computers may be a gift in disguise:

> "Marginal objects, objects with no clear place, play important roles. On the line between categories, they draw attention to how we have drawn the lines. Sometimes they incite us to reaffirm the lines, to sometimes to call them into question. They are the growing point for new learning, new theory building. Computers, as marginal objects on the boundary between the physical and the psychological, force thinking about matter, life, and mind." (Turkle, 1984:42)

Principles to Guide Teacher Training Based on Conclusions from the Literature

1. Effective use of computers with young children depends on the careful training of teachers who will use computers in their classrooms in developmentally-appropriate ways. (Ragsdale 1985; Coburn 1985; Burg 1984)

2. Avoid the use of computers as programmed learning instruments which lead to predefined structures of thought rather than problem-solving and logical thinking skills. (Elkind 1987; Sullivan 1985; Streibel 1984)

3. Computers are useful instruments in classrooms for equalizing and democratizing learning opportunities - for boys and girls, for children of all cultural groups,

for handicapped and normal children. Therefore, teachers should be trained to promote and encourage their use by all children and should alter their teaching strategies with various groups of children to meet the individual differences in ways children approach computers. (Beaty & Tucker 1987; Turkle 1984; Brady & Hill 1984; Malka & Schulman 1986; Behrmann & Levy 1986; Lipinski 1984; Siann & Macleod 1986; Olson & Sullivan 1987)

4. The enhancement of child development is dependent on how computers are used by teachers with children. The selection of software is crucial to the effectiveness of computers in the development of cognitive styles and skills. Therefore, teachers must be trained to evaluate and select software for children which is developmentally-appropriate and growth-enhancing. (Turkle 1984; Papert 1980; Piel & Baller 1986; McGarvey 1986; Burg 1984; Anselmo & Zinck 1987; Shade 1985; Riel 1985; Hungate 1982)

5. Children age three and younger do not show much interest in computers. Four-year-olds demonstrate moderate interest. Five- and six-year-olds are enthusiastic about computers. Therefore, teachers should be trained to use computers with children between the ages of four and six and to integrate computer software with the regular

curriculum in order to facilitate transfer of learning from other media to the computer and vice-versa. (Johnson 1985; Barnes & Hill 1983; Klein 1988)

6. Computers promote learning in social contexts. Therefore teachers should learn where to locate computers in classrooms in order to maximize their use and the social learning and cooperation which may result. (Brady & Hill 1984; Dickson, Patrick & Vereen 1983; Slavin 1980; Beaty & Tucker 1987)

7. Computers possess many characteristics which, with creative teachers, promote creativity. Teachers must be trained to use them creatively with children and to maximize their usefulness as instruments for promoting divergent thinking skills, problem-solving, spatial reasoning skills and representational abilities. (Tisone & Wismar 1985; Steffin 1983; Anselmo & Zinck 1987; Burg 1984; Alexander 1983; Beaty & Tucker 1987; Kim 1985)

8. Children's interaction with computers meets most criteria which define the nature of play when they are used developmentally. Teachers must be trained to promote their use with children in ways that are fun, social and discovery-oriented. (Fein, Campbell & Schwartz 1983; Kimmel 1981)

9. Results from research on the effectiveness of LOGO on the development of cognitive skills are inconclusive. More research is needed. Therefore, until more is known, teachers should be trained to use developmentally-appropriate software with children rather than to insist on programming. Teachers who are ready to experiment with the design of their own programs and teaching children some basic programming skills should be encouraged to further their skills in this area. (Clements 1986; Clements & Gullo 1984; Howell, Scott & Diamond 1987; Simon 1985; Krasnor & Mitterer 1983)

CHAPTER III ANTICIPATED OUTCOMES AND EVALUATION INSTRUMENTS

Goals and Expectations

The writer's intent was to ensure that students in the Early Childhood Education Program be trained in the developmentally-appropriate use of computers for young children. Using the literature researched, the writer investigated the relationship between computer use for young children and child development. The writer also designed a module of computer instruction for a teacher training program that focused on using computer technology as a tool to help strengthen children's natural patterns of growth and development. Given the various constraints operating within the writer's work setting, the training was designed to be basic and practical, at least initially, and did not attempt to include all the skills normally associated with more elaborate computer literacy courses.

The writer planned and implemented the module of training within the strict time constraints of an already tight Program without jeopardizing the Terminal Performance Objectives for Early Childhood Education already mandated by the Ministry of Colleges and Universities. It was important to ensure that the training be tightly constructed and focused on essential skills and attitudes related to developmentally-appropriate practice. The training process endeavored to provide students with basic computer knowledge and some exposure to hardware and software that would be personally as well as professionally useful to them.

The computer module strove to teach students the basic skills and criteria for selecting developmentally-appropriate software for children. The computer literacy skills emphasized in the training process were those that students have to know and perform in order to operate selected software in programs for young children. The module also strove to ensure that students be able to see the relationship between the computer software they select for children to use and the overall developmental goals of curriculum for young children. Students needed to know how to integrate play with computers into the regular curriculum. Given the current thrust toward the design of computer training components for all programs in the College, the writer anticipated receiving management support, funding and resources required to develop a computer education component for the Early Childhood Education Program.

Behavioral Objectives

In order to address the goals outlined above, the writer used the literature as a guide to integrating computer education into the Early Childhood Education Program. The writer requested funding for hardware and software as well as access to laboratory time. It was important to examine carefully the courses taught by the writer in order to determine what type of training might be accommodated within existing time frames and in which course or courses a computer training component might fit with present content and objectives. The writer derived from the literature some principles for computer education including what skills teachers need to acquire, pitfalls to avoid, and attitudes to foster to ensure that teachers use computers in developmentally-appropriate ways with children. The writer previewed, evaluated and purchased a range of software for children which was used to train students. The writer reviewed a range of textbooks addressing computers and early education in order to determine which textbook would best address the objectives of training.

The writer decided on the format and time frame for computer education in the Program. The writer also articulated training objectives for students, content, teaching and learning activities, teaching strategies to be used and evaluation instruments. Training objectives were based on conclusions drawn from the literature about the kind of knowledge, understanding and skills teachers of young children should have about computers, specific hardware including peripherals, software, child development and learning styles in order to train students to use computers in ways that will enhance children's development.

The writer planned to evaluate student performance on the training module using evaluation instruments such as a test and assignments designed by the writer based on the content and objectives of the training process. The writer also decided to require that students evaluate the training they received and use these evaluations to make revisions to the module.

Measurement of Objectives

The writer designed a software evaluation form to be used in evaluating software according to specific, predetermined criteria. The criteria chosen reflected an interest in the graphics capability in the software, its aesthetic quality, the developmental appropriateness of the package and the ease with which it could be used by children.

In the process of planning the component of computer education, the writer designed a module evaluation form which students could use to evaluate the computer training process in which they were engaged. The purpose of the module evaluation was primarily formative in that the writer wanted specific feedback from students which would assist the revision process for the module. The first part of the module evaluation was intended to provide some measure of the success of the first implementation of the module and a guage of student's impressions regarding its value in terms of what they gained from it. The second part sought more specific suggestions regarding how the module might be improved.

The writer also designed assignments and a test in order to evaluate student progress with respect to the training objectives articulated and addressed during the training process. The Field Report and the Computer Literacy Treasure Hunt were designed to ensure that students would gain basic information about computer hardware and peripherals on their own outside of classroom time. These assignments were also constructed so as to ensure that students would become familiar with some basic terminology extant in the computer field. The test was intended to test students' knowledge of the entire range of objectives identified for the module. The multiple-choice format was chosen to provide a relatively objective measure of the amount of knowledge and understanding students had gained about hardware, software, the integration of computers into classrooms, the appropriate use of computer software with young children and the use of software to promote developmental objectives.

It was anticipated that an appropriate standard of achievement would be that 80% of the students would rate the training process as effective with respect to identified objectives. The writer expected that 90% of the students would achieve passing grades on assignments and tests associated with the training module; i.e. a passing grade in any individual component of the ECE training program is set at 50%. In addition, it was anticipated that the software evaluation form would prove to be useful in the selection of developmentally-appropriate software for children.

The writer anticipated that the end result of the project would be a decision to install permanently in the ECE Program a component of computer education for students in the Early Childhood Education Program. It was also expected that computer education would prove beneficial to students both personally and professionally and that graduates would be able to make effective use of their basic knowledge of computers and educational software in the programs where they will eventually be working. The writer planned to provide for each student who successfully completed the computer module a letter stating that they had achieved a certain level of computer skill related to the implementation of computers in programs for young children. (Appendix P)

CHAPTER IV SOLUTION STRATEGY

Description of Selected Solution

Finding a solution to the problem as outlined was complex given the time constraints which operate within the Program. The literature confirmed the importance of computer training for teachers of young children but offered no documented precedents to follow. There were, however, many clues provided in the literature as to the important skills to be addressed in training, the hazards to be avoided, the software to use and the ways in which teachers should be taught to integrate computers into early childhood classrooms.

The writer's favored solution was to integrate a module of computer training into the existing courses which the writer teaches. This solution involved rearranging the existing content and designing a module which would be compatible with existing objectives for the course or courses with which the module would be associated. As classroom hours for addressing existing content and objectives were at a premium, attempting to find time to address a computer module without jeopardizing the mandated objectives for the courses was problematic. The writer also decided to design a computer training module which would involve primarily independent study to be attached to the writer's courses. This solution required minimum use of precious classroom hours but imposed a heavier burden on students who were already pressured in terms of time and course performance standards. Another problem associated with this latter solution was how to incorporate some hours for laboratory practice at the computers. The writer had to decide how many computer laboratory hours would be needed and how many hours to devote to either independent study or classroom instruction time.

A decision was made about the content, objectives, methods, teaching and learning activities, and evaluation instruments which comprised the training module. Some colleges have chosen to provide standard computer literacy courses for their students; such courses are offered by the college computer services departments and are only loosely connected with the vocational program and its specific objectives. The objectives for computer literacy courses are oriented toward understanding the potential of computers for data processing, word processing, information retrieval, programming and software operation. Such courses address computer technology objectives rather than objectives specifically related to choosing appropriate software and the integration and operation of computers within learning environments for children. Other college programs, including one in the writer's own department, focus primarily on classroom and laboratory instruction designed to train students to learn how to use computers for largely administrative purposes and their own personal use as students; i.e. word processors.

The writer designed a module which addresses the use of computer software in learning environments for children. The module was integrated into the courses ECE II, III and IV and adhered to strict time limitations and learning objectives which could realistically be addressed. The decision to teach the module progressively in each of the three semesters was based on the assumption that the objectives related specifically to the use of computers with children could be integrated sequentially with existing course objectives and content. It also meant that the amount of time to be allocated to computer training in any one course was reduced by spreading the module over three semesters.

A large component of the module involved independent study by the students. Computer module assignments were attached to the course evaluation system. The module included a computer laboratory component of approximately six hours taken in two-hour time periods over three classes. Course outlines or class timetables for each of the affected courses had to be reformulated in order to accommodate the module in three semesters. (Appendix E)

The module included a knowledge-based component related to computer terminology, features of hardware and peripherals and the use of software. Basic computer literacy skills such as command of terminology, the handling of disks, turning systems on and off and inserting software, printing, and making backup copies of diskettes were addressed. The knowledge base also included the components of a computer learning center in early childhood classrooms which were addressed under the topic "Designing Learning Centers" in the Early Childhood Education II course. Students actually designed a technology center for the preschool or kindergarten classroom, including all equipment, materials and supplies which would permit children to have easy access to computers and to use them in pairs or small groups. Students also learned about the components of hardware and learned how to research specifications of computer systems as preparation for the purchase of hardware for use by children. The latter skills related to hardware selection were taught by using an independent study assignment associated with the Early Childhood Education III course. (Appendix G)

Another component of the module focused on software selection in which students learned the basic criteria for selecting developmentally-appropriate software and used software evaluation forms to evaluate the quality of software for children. (Appendix L)

A practice component in the laboratory during the Early Childhood Education IV course provided students with the opportunity to practice what they had learned and discussed in class earlier in the module. A Computer Literacy Handout was distributed to students to reinforce the basic knowledge about computers which students would need before entering the lab. (Appendix I) The lab time focused on using the laboratory computers to operate a system, insert and follow software instructions, and use a software evaluation form in the evaluation of software packages.

Another component of the module emphasized the relationship between objectives addressed by computer software packages and the developmental objectives for children articulated in the regular curriculum. By examining software packages in the context of curriculum planning, students investigated how computers can be used as an extension of children's learning through play with concrete objects in the environment. The incorporation of computer education into the curriculum courses facilitated the process of learning to consider the computer as another effective medium for play and learning.

The following plan outlines the format and sequence in which the module addressed the objectives identified for computer training.

Early Childhood Education II. (2 hours of classroom time and an assignment requiring students to draw a layout diagram of a technology learning center)

Objectives: Students will:

- identify and describe the components of a technology learning center;

- decide on the basis of specific planning criteria where the technology learning center is best located in relationship to other learning centers in the classroom;
- arrange the components of the technology learning center on a classroom layout diagram.

Early Childhood Education III - (6 hours of class time; 6 hours of independent assignment)

Objectives: Students will:

- visit a minimum of two computer sales centers to research hardware and software;
- research, by visiting sales centers, three models of computer systems and peripherals and prepare a report which will describe the specifications of each system;
- research educational software for children for each of the three computer systems investigated outlining the specifications of three software packages for each of the three hardware systems;
- evaluate the quality of the sales centers visited in terms of specific criteria and include conclusions in the report assignment;
- examine software and hardware manuals and evaluate the quality of manuals according to specific criteria and include in the report assignment;
- read handouts related to software evaluation;
- read the textbook for the module;

- include on the cognitive curriculum *charts computer-based* activities and the names of software packages which address the cognitive-developmental objectives articulated for the curriculum. (Appendix J)

Early Childhood Education IV - (6 hours of computer laboratory time and 10 hours of class time)

- in the computer laboratory, turn on the computer system, insert software packages and follow instructions contained in the software, and turn off the system;
- evaluate the software packages according to criteria outlined on the software evaluation forms;
- prepare a verbal report on the quality of the software evaluated and present report to the students in class;
- report on where and in what ways the software can be integrated into the curriculum;
- observe a demonstration of the use of a word processor (WordPerfect) and practice writing a note to a friend using the word processor;
- write a test based on the objectives and content of the computer education module;
- evaluate the computer education module and make recommendations for improvements.

Report of Action Taken

The writer designed a module of computer training which is integrated into the second, third and fourth courses in the early childhood education series (ECE II, III, IV). Much of the learning process involves independent study and assignments by students outside of the classroom in order to ensure that valuable classroom time is not taken from other training objectives.

The second course in the series involves the study of learning environments in early childhood education and includes topics such as schedules, use of space, units of play, classroom layout design, planning and setting up of learning centers, choosing equipment, materials and supplies, outdoor playground design, gardening with children and several related topics. The integration of a technology center into the classroom design component of the course provides an occasion to introduce the objectives of computer use by children. The transfer of learning gained in other centers to the technology center and vice versa, the use of equipment, materials and supplies for this center and the location of storage units are all relevant to ECE II objectives.

The juxtaposition of the technology center with other centers is addressed by identifying the goals, objectives and activities that will generally be associated with each center and then determining with which other center's goals objectives and activities the technology area is most compatible in order to facilitate optimal transfer of learning. Students are encouraged to locate technology center near the Quiet/Concepts area in order to complement table top activities, perceptual tasks, Workjobs play, and early reading and number activities, most of which involve individual or small-group play.

This initial section of the computer module also explores the arrangement of the technology center itself. In keeping with much of the literature on the subject, students are encouraged to design a plan which includes two computers, placed at right angles to each other, each with chairs for two children to work cooperatively. This arrangement of the two computers is designed to encourage four children working at two computers to work cooperatively with software and allows all four children to see both monitor screens easily. (Davidson, 1989)

The hardware required for a viable technology center is also discussed very generally. Students are introduced to some basic terminology which describes computer hardware components and learn how they must be located, stored and protected. Other items of technological equipment and materials are introduced into the center also. Students have to consider the educational value and play potential of typewriters, record player and tape recorder with headphones, radio, television, VCR, and interactive teaching/learning toys and games within this learning center. The outcome of this learning process is the design of a technology center using a pencil drawing to indicate location and relative position of all items of technological equipment, space used, accessories and storage required (such as software shelves, diskette storage, computer manuals etc.). Students are also required to do a to-scale drawing of a total learning environment including six or seven learning centers, showing the relative location of technology center with all other centers. The drawing must be accompanied by a written rationale explaining their reasons for the physical organization of the learning centers in the classroom.

To summarize, within the context of the second course in the series, students have stated broad goals and objectives for a technology center in the early childhood classroom, have listed equipment, materials and supplies which should be available in the center, have completed a to-scale drawing outlining the juxtaposition of the technology center with other centers in the preschool classroom and a drawing of the layout of the technology center itself. On the latter drawing, they have included all major items of equipment including storage items, their location, pathways, and number of play spaces available. For an example of a student's to-scale drawing of a classroom including six learning centers, see Appendix K. In addition, students have made to-scale cutouts (using the same scale for their drawings and cutouts) representing all major items of equipment which they can use when they are attempting to create or redesign a learning environment in any early childhood setting. Students therefore addressed and mastered all module objectives identified for the Early Childhood Education II course. (page 65)

The Early Childhood Education III course focuses on curriculum design and activity planning related to cognitive developmental goals and objectives. Within this very full course approximately two hours of class time were allocated to an explanation of the Computer Module Outline (Appendix H), providing handouts and explaining the assignment guide for the Computer Field Report (Appendix G). Handouts included a Computer Literacy Handout (Appendix I), and a short bibliography included with the Module Outline. Students were given two weeks to complete the Computer Field Report which involved their researching in pairs or small groups, three complete microcomputer systems, their specifications, and compatible educational software for young children. In addition to gathering information on a wide range of system specifications, students were required to form some opinions about the systems they examined and to recommend one system for purchase, giving reasons for their choice. They were also expected to conduct their research on hardware systems in at least two separate sales centers and to form some opinion about the quality of the sales center, the helpfulness of salespersons and the value of warranties, follow-up and repair services.

At this initial stage in the actual process of learning about computer hardware some students were very resistant to the Field Report assignment and complained about having to visit sales centers and keep up with all their regular assignments. Many students required help outside of class time, some suggestions about where to look for information, and moral support. Several times it was necessary to remind them to collaborate in small groups or pairs and to visit sales centers together. Frequently, during the two-week period before the Report was due, students had questions and concerns which took class time away from other course content.

At one point, when bombarded by requests for help, the writer inadvertently mentioned the name of a particular computer sales center downtown where salespeople were especially helpful to teachers. Many of the students who were having difficulty with the assignment, or who were resisting it, descended en masse on this center, and complained to staff about the assignment they had to do. When the writer learned of the pressure they were exerting on this sales center, it was necessary to telephone the manager to apologize and explain the purpose of the assignment. Fortunately, the manager was very understanding and, once he understood the rationale for the assignment, offered to be helpful in any way he could. Although students had been urged to present themselves to the sales centers as potential customers, many of them had instead indicated that their purpose was to complete an assignment for a college course. The writer felt somewhat vindicated however, when one student actually purchased a computer system from one of the sales centers she had investigated during the assignment, and several more students indicated that they would be buying computers as soon as they were out in the work force.

A **Computer Literacy Treasure Hunt** (Appendix F) was another independent assignment given to students in groups in the Early Childhood Education IV course to help them review what they had learned about hardware, software, peripherals and terminology during the Field Report assignment in the fall semester. Students had fun with this assignment and the winning group, with the highest score at 42 out of a possible 50 points, received a prize worth having. The writer mentions this assignment in the context of discussion of the ECE III component of the Module, as, in future, the **Treasure Hunt** would be assigned in conjunction with the Field Report to save students some time and to add a little fun and some external motivation to what appeared to be an onerous task for them.

Most of the objectives identified for the Module in the

Early Childhood Education III course were met. (page 66) Those which were not included the following: examine software and hardware manuals and evaluate the quality of manuals according to specific criteria and include in the Report assignment; include on the cognitive curriculum charts the names of software packages articulated for the curriculum. When students began to complain about the length of time the assignment was taking and the difficulty they were having getting information about three hardware systems, the writer agreed to defer software evaluation to the following semester. Some students were able to research and report information related to the above objectives but they were generally students who already had some prior knowledge of computers and sales centers. The majority had their hands full just obtaining the necessary information about the hardware systems and then comparing them and making a selection of one system.

Generally, the quality of the Reports was high and students admitted in the end that the assignment had taught them a great deal. They acknowledged that many barriers to computer technology had disappeared in the process of visiting centers and acquiring information for the assignment.

Students were required to purchase the textbook (Davidson, 1989) and to read most chapters during the ECE III course. The writer selected the Davidson book Children and Computers: Together in the Early Childhood Classroom because of its strong developmental bias and the clarity of its format. Students also commented that the text provided very useful descriptions of specific software packages which they would find useful when using software with children. Of several similar ECE textbooks, the Davidson book promoted best the approach and issues that the writer planned to address in the module.

The major component of the module occurred during the Early Childhood Education IV course in the fourth semester. Sixteen hours of classroom time were allocated to the module including six hours of hands-on learning in the computer laboratory. The computer literacy handout formed the basis of the first class when terms and components of hardware were reviewed and students were required to refer back to the Computer Field Report assignment which outlined the hardware specifications of three systems. Subsequent sessions addressed the integration of a microcomputer into the classroom, introducing the computer to children, basic rules for the use of computers in classrooms, introduction to educational software for children, kinds of educational software, developmental criteria for selecting appropriate software for children, integrating developmentally-appropriate software into the curriculum goals and objectives, software evaluation using standardized forms, what to look for in software manuals, manual evaluation, building a software collection, and issues related to the use of computers with young children.

In the six hours of laboratory time, students were required to practice basic skills in the use of computers such as turning the systems on and off, formatting a diskette, loading software, and following software manual instructions and on-screen instructions. The expectation was that students would work in pairs at systems and, using two different software evaluation forms, evaluate two educational software packages for children. (Appendix L) These software evaluation forms were to be completed as a collaborative assignment for each pair of students. Criteria included evaluation of the software manuals. Time constraints prevented students from presenting the results of their evaluations verbally in class. Instead, software evaluation forms were collected and graded at five marks for each form for a total of 10 marks. In addition, during the six hours of lab time, students were introduced to WordPerfect 5.0 and were required to load the software, follow the training diskette and compose a note to a friend. Students who lacked typing skills were also given an opportunity to use Typing Tutor and to play Word Invaders.

At the conclusion of the module, students were required to write a forty-question multiple choice test. (Appendix M) They were also asked to evaluate the module both verbally in class and using a module evaluation form designed by the writer. (Appendix N) Most objectives for the ECE IV component of the module were met with the exception of the verbal presentation to the class of the results of the software evaluation conducted by students in pairs. (page 67) The tight time-frame for the module did not allow for presentations. Students listed software packages which they had tested which were relevant to specific developmental objectives on the physical curriculum charts they were preparing for the ECE IV course and for the Psychomotor Laboratory course also taught by the writer.

The writer had to enlist the support and assistance of several colleagues in the implementation of the module. A colleague faculty member who is conducting a computer course in another program proved to be helpful, especially when he offered to attend the first class in the computer lab and, along with the writer, to assist students in familiarizing themselves with the computer systems. In addition, the computer lab staff were a necessary source of assistance, especially when some software proved difficult to load.

CHAPTER V. RESULTS, CONCLUSIONS AND RECOMMENDATIONS

Results

Twenty-four students wrote the module test at the conclusion of the module. All students passed the test; the criterion that 90% of students pass the test and assignments was met. Sixteen students scored between 15 and 20 on the test which was valued at 20% of their final grade for the course. The remainder of the students scored between 11 and 14 on the test. All students received high marks on the two software evaluations which they were required to submit for grading valued at 10% of their final grade. The total evaluation for the computer module was worth 30% of the final grade for the course.

The module evaluation form designed by the writer for the course included two parts. Part I includes ten items in a five-point rating scale format. In order to assess the overall rating by students according to items included in Part I, the writer assigned a value of one to the poor rating and a value of five to the excellent rating with two, three and four assigned to the intermediary ratings from poor to excellent. The highest possible score was therefore fifty and the lowest possible score ten. Results of the evaluation of Part I of the form showed that 15 of the 20 students who evaluated the module gave it a rating of 36 or higher out of a total possible score of 50. The average rating was 36 as was the median score. The item which received consistently lower scores than all others was Item number 8 which asked students to rate the computer laboratory facility. The criterion of module effectiveness as indicated by Part I of the evaluation of 80% was not met; instead the score on Part I of the evaluation form was 72%.

Questions in Part II of the evaluation form were designed to provide the writer with specific suggestions for improving the computer module. The results are tabulated and appear in Table I.

Although the evaluation form did not include an item related to the use of the Davidson textbook, informal evaluation revealed that the textbook was a very valuable resource which supported the philosophical approach as well as specific content addressed in the module. Several students commented on the simplicity of the textbook and some complained that they felt the book "talked down to them". In general, however, most students agreed that the textbook will be a useful source of information for the future when they actually attempt to integrate computers into their classrooms.

The two software evaluation forms used were readily interpreted and used by the students. The items which were more difficult for students to rate on both forms related to the graphics capability and color used in the software packages. Rather than indicating a problem with the software evaluation forms, this problem occurred because of the absence of graphics cards and color monitors on the computer systems in the laboratory which students used to evaluate the software.

Table 1. Summary of Results of Module Evaluation Part II *

Question	Yes	No	No Opinion/Not Applicable
1.	11	0	9
2.	19	1	0
4.	5	10	5
6.	19	0	1
7.	17	2	1
8.	7	5	2

3. first place - software evaluation - 8 students
- word processing skills - 6 students
- MS/DOS tutor - 3 students
- administrative applications - 3 students

5. (Only 2 students answered this question.)

* based on 20 students completing the Module Evaluation

Conclusions

The writer has concluded that the computer module has made a significant contribution to the training of students in the Early Childhood Education Program and should be retained as a permanent component of the Program. An important consideration in teaching a computer module to students in early childhood education programs is the attitude that students have toward the training at the outset. Students who were negative or reluctant before the module retained their skepticism throughout the training process although they did concede that they had learned a great deal about computers. The writer did not attempt to convince the negative students that their attitudes were unfounded but did insist that all students participate fully in the learning process. It seemed to be important to the students concerned that the writer concede that some of their skepticism about computers in general and with children in particular might be well-founded. The writer insisted nonetheless, that in order to be a "conscientious objector" it would be important to be informed and familiar with computers and software for children on a first-hand basis. The negative students accepted this approach and participated wholeheartedly.

The quality and efficiency of the computer laboratory, the systems themselves and the software available determines to a large extent the success of the computer module. In this case, the computer laboratory facilities proved to be insufficient for the objectives of the module. It is important to have modern systems, i.e. less than five years old, with built-in graphics cards, preferably VGA cards, and color monitors. The laboratory used in this module contained old systems, without graphics capability, and no color monitors. Students were unable to test and evaluate software meaningfully. Some of the software in the collection would not load into the systems. The laboratory technician had to program the software to load into the systems using a SIM/CGA program which was a complex, time-consuming, and ultimately, unsatisfactory compromise. In the future, it will be important to ensure that the systems are equipped with graphics capability and color monitors or that new systems with these capabilities be purchased.

The writer concluded that more computer laboratory time might be useful assuming that there are enough systems available with the aforementioned specifications. Eight hours of laboratory time and eight hours of classroom time would be a more satisfactory breakdown of the total number of hours allocated to the module in fourth semester.

The use of a largely independent study format to teach several of the module objectives was very successful and saved hours of classroom time. Initially, students resented having to spend time outside of class researching specifications of computer hardware, but, in the end admitted that their time had been well spent and that they had developed a good appreciation of the computer market. The Field Report assignment was especially economical of class time and an effective way to familiarize students with computer hardware, peripherals and the vastness and complexity of the computer market. It is important, however, to ensure that the assignment instructions and requirements are clear, that students are urged to visit sales centers in pairs and not in large groups and that the teacher of the course is very responsive to students' requests for help. It may even be necessary, depending on the size of the community in which the module is conducted, to enlist the support and approval of local sales centers before sending students out to sales centers. Under no circumstances, even in larger communities where there are hundreds of centers from which to choose, should a teacher recommend that students visit one particular sales center unless the manager has been briefed and has granted permission in advance of the assignment for students to visit that particular store.

In total, the computer module, spread over three semesters took approximately 26 hours of classroom time which, with the independent assignments, was sufficient to permit students to master the objectives of the module. Most of the objectives of the computer module project were met.

All of the objectives for Early Childhood Education II were met as were most objectives attributed to Early Childhood Education III as stated in Chapter IV. (Lists of objectives for these courses appear on pages 68-70.) In Early Childhood Education IV, students had only minimal exposure to the use of computers as wordprocessors, although some students did complete the training disk for WordPerfect 5.0 and most managed to write and print out a note to a friend using WP 5.0. Students used two software evaluation forms to evaluate at least two software packages for young children. In many instances, however, the evaluations could not be conducted meaningfully as students were struggling with systems with monochrome monitors which did not do justice to the quality of the software. Often, it was difficult to load the software because of the systems and not because of any fault in the software packages. Students did manage to evaluate the quality of the software manuals and based some of their overall evaluation of a kit on the clarity and overall quality of the manual.

Most of the Module Objectives stated in the Module Outline were met. (Appendix H) In the future, more time will have to be spent relating the use of specific software packages to the developmental objectives of the curriculum for young children. Time pressures prevented full discussion of the use of specific programs to promote transfer of learning acquired in the concrete, physical environment.

The objective relating to the potential of computers for performing administrative tasks in centers and schools such as word processing, data management, record-keeping, information retrieval and financial management, was not addressed in this module. The writer has concluded that a 26-hour module would not allow sufficient time for this objective to be addressed meaningfully and that it is likely an objective that would be better addressed in a course on Administration in Child Care. All other objectives in the Module Outline were met.

The writer has concluded, however, that more time should be spent discussing issues related to the use of computers by children in all three semesters. The Davidson textbook addresses many of the pertinent issues from a developmental perspective.

The seriousness with which the students participated in the module is testimony to the importance of including a module of computer training in early childhood education training programs. One student recently won a competition for a teaching position largely because she was the only candidate with any computer training related to early childhood programs. Another student has purchased her own computer system. Several students have spoken enthusiastically in their field placements about their participation in the computer module. This enthusiasm has generated two calls from teachers in child care centers requesting information, handouts and suggestions from the writer with respect to the purchase and integration of computers into their classrooms.

Recommendations

Given the present ambivalence in the Early Childhood Education profession at the grass roots level regarding the use of computers in programs for young children, faculty in training programs require considerable institutional support in order to offer courses or modules to students. The writer recommends that faculty considering the implementation of computer training ensure that they have institutional support before undertaking the endeavor. It is helpful to enlist the support and guidance of other faculty who have offered similar courses. In colleges and universities, the staff in computer technology programs or staff development offices provide assistance and encouragement. It is vital that funding be provided to ensure that the computer laboratory facility be equipped with enough systems to accommodate all students in pairs at computers at one time. The computer systems should be equipped with internal graphics capability, preferably VGA cards, given that the more sophisticated and newer children's software is tending to require this level of graphics capability. Color monitors are essential to children's software evaluation as monochrome monitors provide very limited opportunity to examine the aesthetic features of programs which are important for children and are also much less interesting for students to test and evaluate.

The writer embarked upon this module on the understanding that very little classroom time would be devoted to basic computer literacy objectives and examination of hardware. The basic literacy skills needed for the module were acquired through assignments undertaken by students outside the classroom. This strategy proved to be economical of time and effective in terms of learning and is highly recommended. It proved to be wise to allocate proportionately more time to addressing objectives related to the integration of computers into classrooms, guidelines for choosing developmentally-appropriate software, issues related to computers and children, the criteria for evaluating educational software, how to use software evaluation forms, integrating software into the goals and objectives of the curriculum, and how to promote transfer of learning from the concrete world of the classroom to the computer and vice versa. Many of the basic literacy skills can be addressed through textbooks, handouts and assignments. This learning should occur before students enter the laboratory for actual hands-on experience. Students reinforce their learning of terminology and functional knowledge of the computer once they are seated in front of the computer and find that this knowledge which involves the function and use of the computer is the easiest to acquire. Operational knowledge of the computer, i.e. understanding how to use the computer with children in order to effect the desired learning and developmental progress is more difficult to grasp. (Davidson, 1989) Classroom time in a short module of computer training should be spent primarily on topics related to operational knowledge.

Finally, the writer has concluded that, at least in the early stages of computer use with young children, very few of the computer "literacy" skills are required and that a module or course should focus on the integration of appropriate software into the developmental curriculum as well as the setting up of a technology center in the classroom. The writer suspects that in the near future, computer literacy courses as we now know them will become obsolete, especially as microcomputers become much easier to use. Assuming that the focus of computer courses for early childhood education students will be the appropriate use of software in classrooms with young children, the teacher of computer courses should have access to a microcomputer with graphics card and color monitor in the classroom where theory and curriculum courses are being taught. In this way, the teacher will be able to demonstrate to students at any time in the course how a particular software package may extend and enrich the child's learning of concepts or practice of specific skills in any developmental domain. The teacher would therefore be demonstrating the full integration of the computer into the classroom and modelling an approach which could be used with young children. It is the writer's belief that as we become more at ease with the notion of computers in ECE, we will be less self-conscious about their use and will matter-of-factly turn to specific software packages to illustrate the use of the computer as another tool for play and learning in the same way that a teacher casually demonstrates the use of blocks, books or paint in the classroom. Assuming that this method will become the standard for the future, the computer laboratory in colleges and universities may become a place where students can go outside of class to practice using specific software, write assignments and work on projects.

Dissemination

Early childhood educators in Ontario seem to lag behind their American counterparts in terms of integrating microcomputers into preschool classrooms, although they are being used much more visibly in public kindergartens and early primary classrooms. The module conducted by the writer has generated considerable interest in the community. Several schools and centers have requested that a computer course be offered as a professional development opportunity through the School of Continuing Education. Two former graduates of the ECE Program have contacted the writer for advice regarding the setting up of a microcomputer in their preschool classrooms.

The writer intends to disseminate the final Report for this project as widely as possible in order to encourage practitioners in the field to consider the issues involved and to become acquainted with some strategies for the implementation of computer technology in centers and schools. The writer will also be available to conduct workshops on the developmental use of computers in ECE through local professional groups and associations. Copies of the literature review have already been made available to persons who are interested in the issues surrounding the use of computers with young children. The writer also intends to write an article for publication on the planning and outcomes of the module in order to promote the pre-service training of potential teachers of young children in the developmentally-appropriate use of computers in ECE.

The writer is also a member of a departmental task force on Computers in Curriculum for the department in which she is employed and has already offered suggestions to other faculty members about some possible ways of introducing computers to their students. Recently, the writer was also asked to contribute an article to the College newsletter Algonquin Computes describing the module and the teaching strategies used. (Appendix O)

The writer would like to conduct another workshop for the NAEYC Conference in 1991 and plans to submit a proposal in January for a session on the design and implementation of training modules for students in early childhood education programs.

It is the writer's hope that faculty at other colleges which offer Early Childhood Education training programs will use the module and modify it to suit their own course structures and student needs.

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APPENDIX A

SURVEY QUESTIONNAIRE

SURVEY RE COMPUTER INSTRUCTION FOR STUDENTS IN EARLY CHILDHOOD EDUCATION

		YES	NO
1.	Do you have a computer where you live currently?	28	62
2.	Have you ever played computer games?	80	10
3.	Do you use a word processor?	34	56
4.	Do you know how to turn a computer on and off and load software? Comments:	70	20
5.	Are you able to follow most software instructions? Comments:	65	25
6.	Would you like to learn how to use a computer in order to do assignments, maintain files, etc.? Comments:	76	10
7.	Do you believe that children should be introduced to computers when they are in preschool or kindergarten? Comments:	67	20
8.	Do you believe that computers can provide learning opportunities that will enhance children's early development?	70	16
9.	Would you like to see a module of training on computers in early childhood education addedc to the ECE Program?	73	12
10.	Please list below the kinds of knowledge you would like to have about computers for your own personal use and for your professional use as a preschool teacher.		

Thank you for responding to this survey.

*Total number surveyed - 90 students

APPENDIX B

LETTER RE REVISIONS TO TERMINAL PERFORMANCE OBJECTIVES

ECE RESEARCH GROUP

September 15, 1989.

Dear ,

During the summer, the Ontario ECE Coordinators' Project was approved, effective September 1, 1989, by the Child Care Initiatives Fund, Health and Welfare Canada.

You will recall that the project was to identify professional competencies of ECE graduates of Ontario's CAAT's. Dramatic changes in child care have led to the need to more carefully define the kinds of competencies which can and should be expected of our graduates. Such a set of definitions has not been undertaken since The Training Profile in 1984.

Things are under way. We have spent the last week or so renting office space and buying and putting together office furniture.

We are eager to have input from any of you whose programs have evaluation forms which are competency-based. We have received such information from a number of colleges, but not from all. If you haven't already done so, would you forward such information to us? We would appreciate it.

As the project proceeds, we will be forwarding to you material to both inform you of what we are doing and suggestions as to how you can assist us.

For your information, the following persons are "on staff":

Co-chairs: who will be in the office Monday afternoons, Tuesdays and Wednesday mornings;

of College, who will be in the office all day Monday and Tuesday;

Office administrator: who will be in the office Mondays, Tuesdays, Thursdays and Fridays.

Our new address and telephone number appear at the top of this page.

We would appreciate any suggestions you have to offer. Please contact us by mail or telephone.

Yours truly,

Co-chairman.

APPENDIX C

PROFESSIONAL DEVELOPMENT COURSES ON COMPUTER LITERACY

ALGONQUIN COLLEGE OF APPLIED ARTS AND TECHNOLOGY
COLLÈGE DES ARTS APPLIQUÉS ET DE TECHNOLOGIE
1644 BANK STREET OTTAWA, ONTARIO K1V 7Y6 1644, RUE BANK

PROFESSIONAL DEVELOPMENT

WORKSHOPS

PERFECTIONNEMENT PROFESSIONNEL

ATELIERS

89-08-21

The Educational Services and Staff Development Department is pleased to announce that the following professional development sessions will be offered to the College Community between September and December. A schedule will be announced later in the semester for the period of December 11 to 22.

ALL THE COURSES WILL BE GIVEN IN ROOM C338G - WOODROFFE CAMPUS.

Courses are limited to nine (9) participants.

Le département des Services de développement pédagogique et perfectionnement professionnel a le plaisir de vous annoncer que les ateliers suivants seront offerts à la communauté collégiale de septembre à décembre. Un horaire sera annoncé plus tard dans le semestre pour la période du 11 au 22 décembre.

TOUS LES COURS SERONT DONNÉS DANS LA PIECE C338G - CAMPUS WOODROFFE.

Le nombre maximum de participants par cours est limité à neuf (9).

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1. LOTUS 1-2-3 INTRODUCTION

Cette introduction au chiffrier électronique le plus populaire, permettra aux participants d'en connaître le concept et le fonctionnement.

Objectifs:
- apprendre la construction, le design et l'impression du chiffrier
- appliquer Lotus 1-2-3 aux mathématiques, aux fonctions commerciales et statistiques
- apprendre à conserver, à retrouver, à effacer les fichiers et à structurer les filières.

Pré-requis: Introduction aux microcordinateurs. Une session de 2 jours.

Veuillez apporter 2 diskettes vierges.

11 et 12 septembre, 9h - 16h

5	INTRODUCTION AU MS-DOS	Cet atelier permettra aux participants de développer leurs connaissances et leurs habiletés à utiliser le programme MS-DOS. Nous présenterons les éléments de contenu suivants: . les concepts généraux . la terminologie . revision des commandes simples . les commandes pour gérer les fichiers . démonstration des fichiers .BAT **Pré-requis:** Introduction aux microordinateurs ou l'équivalent. Veuillez apporter 2 diskettes vierges. **26 septembre, 9h à 16h**
6.	MS DOS ADVANCED	Upon completion of the workshop, participants will be able to use DOS to manage files stored on hard disks. They will be able to: . use a greater selection of DOS commands . create directories and sub-directories . move files between directories and between the hard disk and a floppy diskette . create and edit text files using the text editor EDLIN . create .BAT files . describe the initialization of a hard disk **Prerequisite:** MS-DOS Introduction or equivalent. Please bring a formatted diskette and, if possible, a DOS manual to class. A 2-day session. **September 28 and 29, 0900 - 1600**
7.	INTRODUCTION AU WORDPERFECT 5.0	Cet atelier permettra aux participants de comprendre les concepts généraux du traitement de texte WORDPERFECT (version 5.0) et de connaître les fonctions suivantes: entrée, sortie, effets spéciaux, format, impression, etc. **Pré-requis:** Introduction aux microordinateurs ou l'équivalent. Veuillez apporter 2 diskettes vierges. Une session de 2 jours. **4 et 5 octobre, 9h - 16h**

10. INTRODUCTION TO MS-DOS

Upon completion of the workshop, participants will have gained a sound working knowledge of the program MS-DOS. The course leader will use lectures and hands-on exercises to present the following:

- the terminology necessary to understand and use DOS
- a review of simple DOS commands
- the use of DOS to manage files
- the use of the text editor, EDLIN
- the use of batch files to create your own commands
- the use of DOS to manage a hard disk

Prerequisite: The course Introduction to Microcomputers or experience using a computer.

Please bring 2 blank diskettes and if possible, a DOS manual to class.

October 16, 0900 - 1600

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11. INTRODUCTION TO LOTUS 1-2-3

An introduction to the most popular spreadsheet program used today. The course will develop a basic conceptual and operational knowledge of Lotus 1-2-3.

Objectives:

- to learn the construction, formatting, and printing of spreadsheet
- to use Lotus 1-2-3 built in mathematical and business functions
- to learn how to save, retrieve, and erase files
- to use some advanced Lotus 1-2-3 features such as graphics, windows, and templates.

Prerequisite: Introduction to Microcomputers or equivalent.

Please bring 2 blank diskettes to class.

A 2-day session.

October 17 and 18, 0900 - 1600

[illegible].	WORDPERFECT 5.0 AVANCÉ	A la fin de cet atelier, les participants pourront utiliser les techniques avancées du Wordperfect. Ils apprendront aussi a utiliser le manuel pour la solution des problèmes et l'auto-apprentissage. **Contenu:** . tableaux, les colonnes, macros-commandes, fusion, mise en page **Pré-requis:** Introduction au Wordperfect ou l'équivalent. Une session de 2 jours. Veuillez apporter 2 diskettes mises en forme et le manuel pour Wordperfect. **30 et 31 octobre, 9h - 16h**
15.	UPGRADING WORDPERFECT TO 5.0 VERSION	This course is designed to introduce participants, who are already using version 4.2, to the advanced features of Wordperfect 5.0 version. **Prerequisite:** Wordperfect 4.2. Please bring 2 blank diskettes to class. **November 1, 0900 - 1600**
16.	SOFTWARE APPLICATIONS	During this session, software related to sciences and math will be presented. More detailed information on the software available for the demonstration, will be sent out to those who register now. **November 3, 0900 - 1600**
17.	INTRODUCTION TO WORDPERFECT 5.0	Upon completing this session, participants will be familiar with the general concepts of word processing and how they are implemented with the program Wordperfect version 5.0. The course will include: Basic functions, printing, format, etc. **Prerequisite:** Introduction to Microcomputers or some experience using a computer. Please bring 2 blank diskettes to class. A 2-day session. **November 6 and 7, 0900 - 1600**

APPENDIX D

ARTICLE ON NEED FOR COMPUTER TRAINING

Tots tackle computers before books

By Marjorie Gillies
Citizen staff writer

"You did it!" cheers 2½-year-old Andrea De Laat as Christopher Liu matches up shapes on a micro-computer. "Now, me."

But Christopher, who is 3, isn't ready to give up yet. He's having too much fun matching keyboard numbers with TV-screen numbers next to bright colored shapes.

Computer toddlers Andrea and Christopher are two of the 16 pre-schoolers at Cambridge Baby Academy now becoming computer-literate before they know how to read.

Emily Griffiths, at 4, already works as a buddy to the toddlers, adding the reinforcement of achievement from another child. But then Andrea's a whiz because of the time she spends with mind-stimulating programs her [illegible]-year-old brother designs on their home computer.

Joan Schlachta, owner-director of the Ottawa day care centre on Cambridge Street where the children of diplomats and professionals go (Joe Clark's daughter, Catherine, went there), believes the academy is the only centre in town with computers.

She purchased the two Texas Instrument computers as another early childhood education method to teaching, an alternative to traditional teacher/student instruction.

In the eight weeks since the units were installed the kids, who never showed any intimidation to the units, have become totally comfortable at the keyboard. "In fact," says Schlachta, "they delight in the power and control they have over a TV [illegible]."

A former representative for Lakeview public school on the Carleton Council, a parent advisory board to the Carleton Board of Education, Schlachta feels the microcomputers (purchased for $100 each when TI decided to stick with software not hardware) gives toddlers from 2½ to 5 the kind of exposure that equips them to handle new experiences in future.

"There's no pressure put on the children to use the units or to stick with them for long periods of time," says Helen Cross, head teacher at the academy. "Mostly, it's a matter of concentration span. Some stay 20 minutes, some stay five minutes, always with teacher-assistance to familiarize them with a program, build confidence, provide encouragement."

Dale Shipley, co-ordinator of the early childhood education program at Algonquin College, sees nothing but advantages to early introduction of computers at the pre-school level and hopes to see them included on the college course in coming months.

"They're excellent for developing physical, visual and audio skills; fine motor skills too. And since computers are not going to go away, the more exposure children have to them, the more opportunities they'll have to success at school and in the workplace."

In Oakville, where 'bite-size' computer classes have been offered to pre-schoolers for the last four years at the town library, toddler participants have learned to recognize the letters of the alphabet, numbers, colors and shapes over 10-week sessions they perceive as fun time, where they play lively, colorful games.

Murray Godson, publicist for the computer acquaintance centres at the Oakville library says the program has been very successful, not only with the pre-schoolers but in bringing in their parents. "We've found the idea has helped to break adult barriers to new technology. Seeing young offspring so interes and eager to learn more has parents to become familiar w the hardware too, grow m open-minded about their us he says.

There are no drop-outs in toddler program, says Gods although some are more terested than others, just some adults react differen than others.

As computer toddlers at academy grow familiar with s tware programs Schlachta s new material will be introduc

From personal experience s notices a change in her o son's faster reaction to sch work since he's been play video games. "He's always b a perfectionist, taking longer complete things than mc With the games he's learned has to speed up to achieve," explains.

Academy fees are $120 week for toddlers.

—Paul Latour, Cit

Andrea De Laat, 2½, cheers on fellow computer operator Emily Griffiths, 4, left

APPENDIX E

COURSE OUTLINES

EARLY CHILDHOOD EDUCATION PROGRAM

FAM 1041 Early Childhood Education IV

Teacher: Dale Shipley Winter Semester 1990

COURSE DESCRIPTION

This final course in the series continues the curriculum design focus of third semester with an emphasis on physical curriculum for early childhood, school-age child care, and multicultural education. A module of computer education for early childhood is included. The formulation and writing of a personal philosophy of early childhood education challenges students to synthesize and consolidate learning gained in all four semesters.

TEXTBOOKS

Shipley, Dale. 1990. Physical Curriculum for Early Childhood. Ottawa: Media Algonquin.

Eliason, C.F.& Jenkins, L.T. 1986. A Practical Guide to Early Childhood Curriculum. Third Edition. Columbus: Merrill.

Davidson, Jane Ilene. 1989. Children and Computers Together in the Early Childhood Classroom. Albany: Delmar.

OBJECTIVES

Students will learn to:

- organize resource materials, curriculum components and activities;
- plan and evaluate curriculum to promote children's physical development;
- plan programs for school-age children in child care;
- integrate into all curricula for young children principles, objectives, activities and an overall approach which reflects Canada's multicultural status as a Nation;
- choose, purchase, integrate and use microcomputers in the preschool and kindergarten classroom in developmentally-appropriate ways;
- communicate clearly and concisely a personal philosophy of early childhood education which represents a consolidation of theoretical and practical learning in the training program.

EVALUATION

School-Age Program Plan	15
Activity Card File System	15
Computer Module assignments	30
Philosophy Statement	20
Test on Physical Curriculum	20
	100

Note: Regular attendance in class is essential to successful mastery of the content of this course. In order to receive a passing grade, all assignments must be completed and submitted within the specified time frames. In addition to tests and assignments, regular homework consisting of readings and questions to be answered are an integral part of this course.

TIMETABLE

Week	Topics	Readings and Assignments
1 - Feb.5-9	Block Placement	
2 - Feb.12-16	Physical Curriculum	Shipley: Ch. 1,2,3.
3 - Feb.19-23	Physical Curriculum	Shipley: Ch. 4,5,6
4 - Feb.26-2	Physical Curriculum Computer Module	* Test Davidson: Ch.:2,4,5,7
5 - Mar.5-9	Computer Module	Davidson: Ch.:3,6,8,1
6 - Mar.12-16	Computer Module	Davidson: Ch.:11,9
7 - Mar.19-23	Computer Module	Davidson: Ch.:10
8 - Mar.26-30	Computer Module	handouts * assignments due
9 - Apr.2-6	School-Age Programs	handouts
10- Apr.9-12	School-Age Programs	
11- Apr.17-20	School-Age Programs	* assignment due
12- Apr.23-27	Multiculturalism	handouts * A-Card systems due
13- Apr.30-4	Multiculturalism	
14- May 7-11	Multiculturalism	
15- May 14-18	Philosophy of ECE	*Philosophy statement due

OUTLINE FOR COMPUTERS IN EARLY CHILDHOOD EDUCATION MODULE
ECE IV

Class	Topic	Readings and Assignments
1	Terminology; Computer "literacy"; Treasure hunt.	Glossary of terms literacy handouts Davidson: Ch. 2:22-41; 4:56-62; 7:125-134.
2	Basic skills for using the computer; Rules for the lab; The software collection.	*Treasure Hunt due Davidson: Ch.5:66-90
3	(first laboratory class) Demonstration and practice of basic skills: on/off; load; etc. Selection of software kit; Load software and examine Sign out software kit.	Davidson: Ch. 3:43-54 Ch. 6:93-123 Ch. 8:137-173 Manual for software kit
4	Criteria for selecting developmentally-appropriate software; Software evaluation form.	Davidson: Ch. 1:2-19
5	(second laboratory class) Evaluate software kit using evaluation form.	Davidson: Ch. 11:240-255
6	Integrating computers into the ECE classroom; introducing them to children; transferring learning from concrete world.	Davidson: Ch.9:176-206
7	(third laboratory class) Complete evaluation of software kit; Demonstrate WordPerfect; Administrative software.	Davidson: Ch.10:208-237
8	Issues related to computers in ECE; List and classify software evaluated according to developmental appropriateness; Building a software collection; Evaluate module.	*software evaluation form due

APPENDIX F

THE GREAT COMPUTER LITERACY TREASURE HUNT

THE GREAT COMPUTER LITERACY TREASURE HUNT

(adapted from one designed by Rose Anne Leonard, Educational Services, Algonquin College)

Note: Students will work in groups of four to assemble the following items for class. A prize will be offered to the winning team.

Treasure	Point Value
a plastic box to hold diskettes	3
the telephone number of a micro-computer user's group in Ottawa and the date of its next meeting	5
a book about MS-DOS and a short reading from it to the class about a command you have used	4
an educational software catalogue	4
a cartoon about computers	5
a computer magazine	3
an 8" diskette or a 3 1/2" diskette	3
a brochure advertising a particular computer hardware system	4
a copy of a newsletter from a computer user group	5
the names of two computer-related courses offered by Algonquin's School of Continuing Education	4
the name and address of a child care centre or preschool in Ottawa which provides a microcomputer for children to use	4
a book about wordprocessing	4
a brochure advertising a specific kind of printer	2
Total possible score:	50 points

The teacher reserves the right to rule on any "disagreements" or in the event of a tie!

APPENDIX G

COMPUTER FIELD REPORT ASSIGNMENT

ASSIGNMENT GUIDE FOR FIELD REPORT

Purpose of the Assignment

This assignment is designed to familiarize students with a variety of hardware and software for children and gain specific information about various widely-available computer products.

Tasks

A. Students are required to visit a variety of computer sales centres to gather the following information and submit a Report.

1. Research three microcomputer hardware systems and record the following information about each system:

   name of system and where it is sold - include the name of the sales centre and the name of the salesperson who assisted you, as well as the date and time of your visit;

   description of the system: i.e. memory/capacity, number of components - e.g. monitor, keyboard, etc., graphics capabilities, keyboard style, disk drives, compatible printers, cost, other features included in the basic system.

2. Research the educational software for young children (ages 3 to eight approximately) that is available for each of the three microcomputer systems you have examined. List three software packages for children approximately 3 to 8 that are available for each of the three microcomputer systems you have described in #1 above. (You will have examined nine software packages in all.)

3. For each of the nine software packages you examine, provide the following information:

   name of software package, age levels recommended, cost, type of system(s) with which the software is compatible, subject matter and skills addressed by the software, overall size and quality of the software Manual (clarity, simplicity), type of monitor required for the software to operate well.

4. Form some opinion about which sales centre you would choose to purchase a computer system and software based on the following criteria:

   cost, knowledgability of sales staff, warranty and service available, "user friendliness" of the establishment - i.e. do they demonstrate interest in serving "smaller" clients like child care centres and teachers?

   The above task will require that you have visited more than two sales centres in order to draw comparisons and form some opinions about the differences in services available in the area.

B. Prepare a Report of your findings, (using a wordprocessor if possible). If you are unable to use a wordprocessor, you may handwrite or type your Report neatly on no more than six pages. Include in the Report the information you have obtained by addressing Tasks 1 - 4 above. Format your information neatly and clearly in order that your Report will be a useful future reference for you when you are teaching.

The concluding section of your report should indicate the kind of system you would purchase for a program for young children and the reasons for your choice as well as a short list of software which you would use with children.

Due Date for Report : October 4, 1989.

Note to the Student:

It is anticipated that the tasks involved in this assignment will require the equivalent of two afternoons or evenings from 2 to 5 p.m. or 6 to 9 p.m. This time frame assumes that you will have gained some familiarity with the vocabulary associated with computers and software before your visits and will have some idea of the questions to ask and what to look for when you go to the sales centres. I suggest that you plan to spend a couple of Tuesday afternoons (after Child Development) early in the school year from 2 to 5 p.m. and perhaps make your visits in pairs so that you may help each other. If you do collaborate with one other person on this assignment, be sure to indicate on your paper the name of the other person with whom you collaborated.

Have fun! It's a whole new world to explore for those of you who are just beginning your acquaintance with computers!

DS

APPENDIX H

COMPUTER MODULE OUTLINE

USING TECHNOLOGY TO ENHANCE CHILDREN'S LEARNING IN EARLY CHILDHOOD EDUCATION

An Introductory Module

Module Description:

This introductory module will be attached to the course FAM 1031 and will focus on the background information and skills students need to develop in order to use microcomputers as tools for play and learning. Students will learn some computer terminology, become familiar with the types of hardware, software and peripherals available, and learn some guidelines for selecting developmentally appropriate software for children and integrating it into the learning environment and curriculum. The emphasis in the Module will always be on the appropriate use of microcomputers as accessories in a regular play-oriented program to enhance children's normal development and learning. As this introductory module must of necessity be incorporated into the existing time frame for courses in Early Childhood Education much of the content and many of the objectives will be addressed by students through independent study and assignments. Some class time will be devoted to discussion of assigned readings, independent research, and issues and questions related to the use of technology in programs for young children.

Module Objectives:

Students will:

examine major microcomputer systems on the market which will handle educational software for children;

follow environmental design principles in setting up a technology centre in the learning environment;

design a technology centre for the early childhood education classroom;

establish guidelines for the setting of important rules for the appropriate use of computers by children in centres and schools;

consider some issues involved in computer education for young children;

learn guidelines for the selection of appropriate hardware for preschools, kindergartens and child care programs;

learn guidelines for the selection of developmentally-appropriate software for young children;

use software evaluation forms;

learn how to use software programs to promote transfer of learning already acquired in the concrete, physical learning environment;

become aware of the potential of computers for performing administrative tasks in centres and schools such as wordprocessing, data management, record-keeping, information retrieval, financial management, etc.

Note: Depending on the availability of space for our classes in the campus computer laboratory, an additional hands-on module will be added to provide practical experience for students on computers and to develop some computer literacy skills such as the following:

turn the system on and off;

install/load software into the computer system and follow software manual instructions;

load and use MS/DOS and learn what it does;

experience the convenience and freedom of wordprocessing;

test and evaluate software for children.

Format for the Module:

Students should refer to the ECE III Course Outline Timetable for the specific dates when the Computer Module will be addressed.

Textbook for the Module:

Davidson, Jane Ilene. 1989. Children and Computers Together in the Early Childhood Classroom. Albany: Delmar.

Students are required to purchase this textbook in the College Bookstore before October or as soon as it becomes available. In addition, students will receive handouts and articles as a well as a bibliography of relevant, selected readings.

Module Assignments: (see Course Outline: Evaluation)

Technology Field Report	10%	(see Assignment Guide)
Final Test (some questions)	20%	

SOME INTERESTING READING ABOUT COMPUTERS AND YOUNG CHILDREN

Anselmo, Sandra & Zinck, R. Ann. 1987. Computers for Young Children? Perhaps. Young Children. March, 1987.

Beaty, Janice J. & Tucker, W. Hugh. 1987. The Computer as a Paintbrush: Creative Uses for the Personal Computer in the Preschool Classroom. Columbus: Merrill.

Brady, Elizabeth H. & Hill, Shirley. 1984. Young Children and Microcomputers: Research Issues and Directions. Young Children. 39 (3): 49-59.

Burg, Karen. 1984. The Microcomputer in the Kindergarten: A Magical, Useful, Expensive Toy. Young Children. 39 (3): 28-33.

Clements, Douglas H. 1987. Computers and Young Children: A Review of Research. Young Children. Novemeber, 1987.

Hoot, James L. 1986. Computers in Early Childhood Education: Issues and Practices. (see Colonel By Resource Centre LB 1140.35 C64.

Papert, Seymour. 1980. Mindstorms: Children, Computers and Powerful Ideas. New York: Basic.

Simon, Tony. 1985. Play and Learning with Computers. Early Childhood Development and Care. 19 (1-2): 69-78.

Turkle, Sherry. 1984. The Second Self: Computers and the Human Spirit. New York: Simon & Schuster.

ASSIGNMENTS AND CLASSROOM TASKS FOR COMPUTERS IN EARLY CHILDHOOD EDUCATION MODULE

1. Field Report on Specifications of Computer Systems;
    study of the hardware
    criteria for the purchase of hardware
    criteria for evaluating sales centers 10%
    (Fall Semester)

2. Homework: Class # 2.

    Make a list of rules for children to follow when using the technology center.
    (Winter)

3. Evaluate one software kit; use the software evaluation form 10%
    (Winter)

4. Test (Winter) 20%

5. Treasure Hunt in groups. (Winter)

6. Homework: List the major issues in computer education for young children. (Winter)

7. Classroom activity: Prepare a list of software that meets the developmental criteria on the software evaluation form. (Winter)

APPENDIX I

COMPUTER LITERACY HANDOUT

produced by

Educational Services and Staff Development
Algonquin College

1989

COMPUTER LITERACY

TIPS FOR LEARNING - TRADE SECRETS

1. Keep notes in a book. There is too much to remember.

2. Look for good reference books.

3. Ask questions all the time, especially dumb ones.

4. Have information to trade: the telephone numbers of bulletin boards, where to buy inexpensive diskettes or where you can get software to preview. Never pass up the chance to get a copy of software. Sharing information, the name of a good magazine, or book, or store; all of this opens the door to more information.

5. Take breaks. It is almost impossible not to become frustrated. Don't be drawn into competition with the machine and the software.

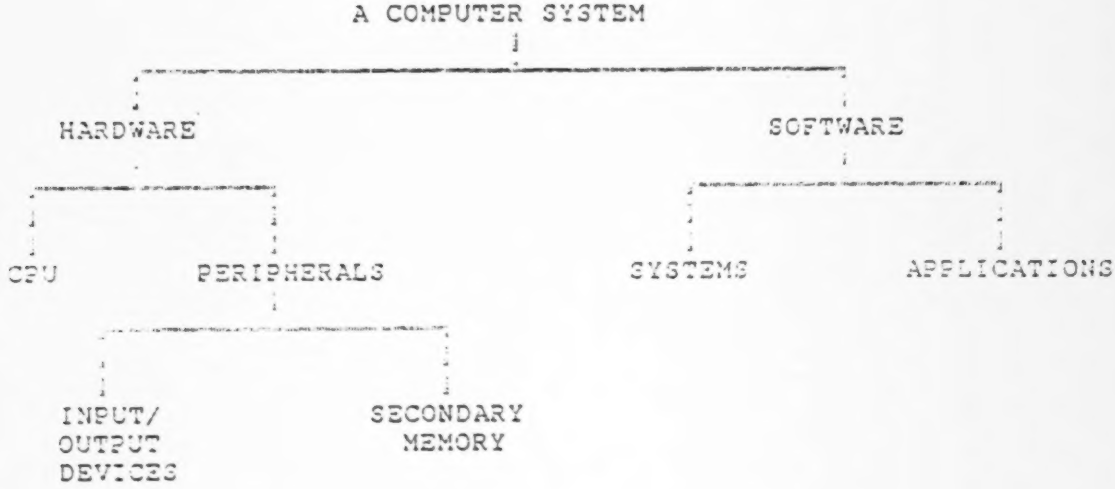
6. Learn with someone. It's more fun and faster.

7. Keep lists of questions concerning things you're curious about but don't have time to investigate. Having the list reminds you to ask when the opportunity arises.

8. Keep reading documentation. Look up the instructions in a manual, especially after you know how to put a piece of software or hardware to work.

9. Look back on how much you have learned. Be patient. In this field you never know everything you would like to.

Educational Services and Staff
Development, 1989.


A COMPUTER SYSTEM
HARDWARE
SOFTWARE
CPU
PERIPHERALS
SYSTEMS
APPLICATIONS
INPUT/
OUTPUT
DEVICES
SECONDARY
MEMORY

HARDWARE	All the physical parts of a computer including the connections.
SOFTWARE	The step-by-step instructions (program) that tell a computer what to do.
CPU	The Central Processing Unit is the brain of the computer. It does the actual math and logic operations.
PERIPHERALS	Devices that work in combination with a computer but are not physically part of the computer.
SYSTEM SOFTWARE	Programs that control the operation of all or part of the computer system such as operating the printer.
APPLICATION SOFTWARE	Programs that perform a specific task such as word processing.
INPUT/OUTPUT DEVICES	Devices that let the computer read and write data.
SECONDARY MEMORY	Memory that is found outside the main memory of the computer such as disks and tapes.

Educational Services and
Staff Development, 1989

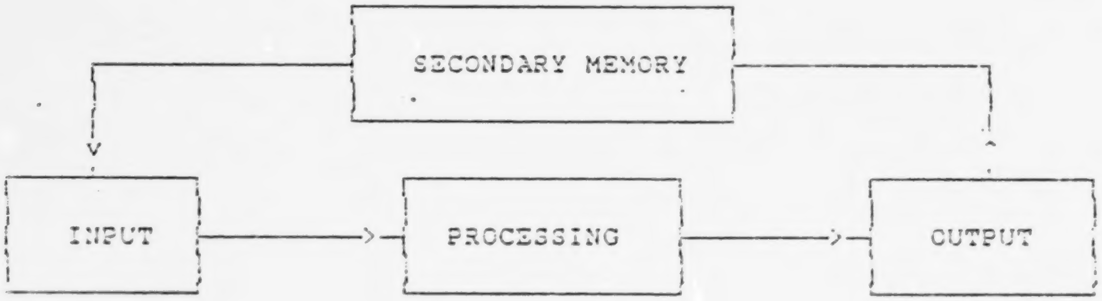
WHAT IS A COMPUTER?

A computer is a device that:

1. Accepts information in the form of
    a) a program,
    b) or data;
    c) or commands
2. does math or logic operations,
3. gives results.

THE DATA PROCESSING CYCLE

The data processing cycle means entering information into a computer, processing it, and obtaining results in a usable form. The following diagram illustrates the data processing cycle:



Different devices are used for each part of the cycle and some of them are listed below:

SECONDARY MEMORY	INPUT DEVICES	PROCESSING	OUTPUT DEVICES
Tapes	Keyboard	CPU	Monitor
Diskettes	Mouse	Memory	Printer
Hard disks	Light pen	(RAM, ROM)	Plotter
	Disk drives		Disk drives

Educational Services and
Staff Development, 1989.

MEMORY

There are 3 kinds of memory associated with a computer:

1. Secondary memory (disk storage)

   This term refers to diskettes, hard disks or tapes where programs and data are stored when they are not in use.

2. RAM Random Access Memory (computer memory)

   When you type the command to run a program (e.g. WP to run a word processing program), the first step performed by the computer is to copy the program from disk storage into RAM. When you begin work on your memo, the text you enter is also stored in RAM. RAM is a temporary work space. Your work will be erased if you do not save it onto a disk before any one of the following occurs:

   a) you quit the program,

   b) you turn off the computer,

   c) someone accidentally pulls the plug from the power supply,

   d) there is a power failure.

   Memory is measured in bytes. One byte of memory will hold one keyboard character. One page of a book would require about as many bytes of storage as there are letters on the page.

   One "K" or one "K"byte = 1024 bytes.

   256K = 256 X 1024 bytes.

   1MB = one megabyte = 1024 "K"bytes

   If you buy a program which requires 250K of RAM and your computer contains 64K of RAM, the program will not run on your computer.

3. ROM Read Only Memory

   ROM contains the instructions which the computer uses to move information through its circuits. ROM is pre-programmed by the manufacturer and cannot be deleted.

   All commands you give a computer must be translated into the instructions which are stored in ROM before the machine can respond.

SOFTWARE

WHAT IS SOFTWARE?

- Software means the programs which are written in a language that the computer understands.

- Programs are written in a programming language like BASIC.

WHAT IS A PROGRAM?

- A program is a group of instructions that tells the computer what to do.

HOW DOES A PROGRAM GET INTO THE COMPUTER?

- From a keyboard

- From a disk

WHERE DO PROGRAMS COME FROM?

- You can buy them at a computer store.

- You can write your own software by keying in programs from the keyboard.

- You can get copies of software in the public domain from users' groups or over the telephone.

- You can type in programs from computer magazines and computer books.

WHAT TYPES OF SOFTWARE ARE AVAILABLE?

- System software,
- educational software,
- word processing software,
- data base software,
- spreadsheet software,
- games,
- graphics,
- communications software.

Educational Services and
Staff Development, 1989.

EDUCATIONAL SOFTWARE

WHAT IS EDUCATIONAL SOFTWARE?

Educational software means programs that help you to do one of two things:

- master a skill like multiplication tables,
- learn something new.

WHAT ARE THE ADVANTAGES OF EDUCATIONAL SOFTWARE?

- It makes learning fun and interesting,
- it lets you know immediately if your answer is correct,
- it gives you the opportunity to learn independently,
- graphics and color make the computer's response to your input very entertaining.

WHAT KINDS OF EDUCATIONAL SOFTWARE ARE AVAILABLE?

1. Drill and practice
    - like an electronic flash card
    - the computer asks a question
    - you answer
    - computer says if your answer is correct
    - this routine is repeated
    - when you finish, the computer tells you how many questions you did and how many questions were right.

2. Tutorial software
    - this is a program that teaches you something; the Bank Street Writer Tutorial teaches you how to use a word processing program.
    - the program asks you questions
    - you answer and the program should move you through a series of questions depending on the answers you give
    - if you are having difficulty, the program will give you more information and more questions until you know the work.

3. Simulation
    - this is a program that is a model of a real life event
    - this kind of program lets you take part in an event that you might not be able to experience in real life
    - a simulation could be a famous battle in World War II or it could be flying an airplane
    - a simulation lets you learn more about what happens during an airplane flight, for example
    - it also lets you learn more about what decisions have to be made.

Educational Services and
Staff Development, 1989

APPENDIX J

CURRICULUM CHART OUTLINE

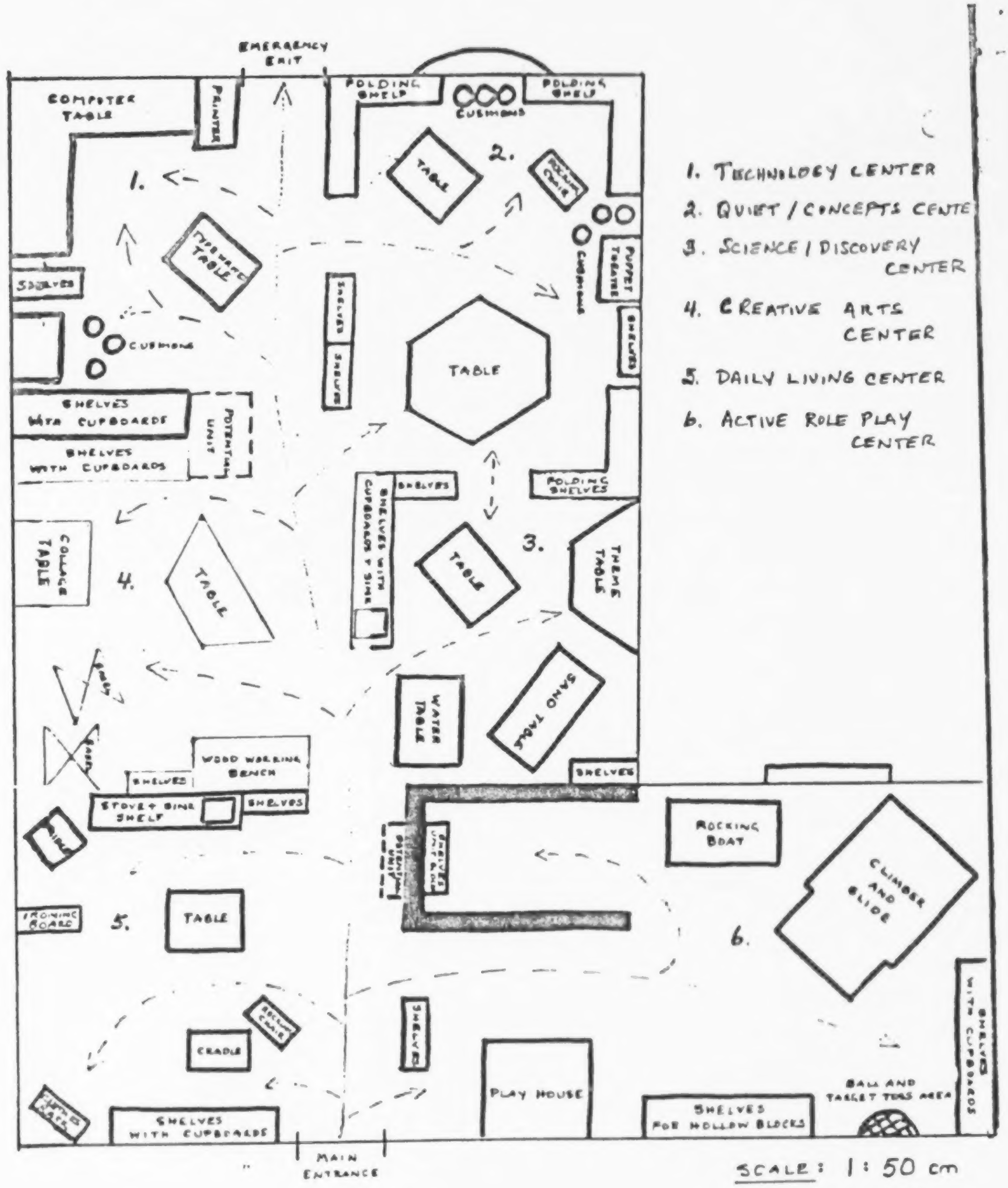
CURRICULUM CHART

GOAL: To promote development of ______ CURRICULUM AREA: ______ PAGE: ______

OBJECTIVES	SUB OBJECTIVES	ACTIVITIES (Sequenced)	TEACHING/LEARNING METHODS

APPENDIX K

EXAMPLE OF A STUDENT'S DIAGRAM OUTLINING CLASSROOM ARRANGEMENT OF LEARNING CENTERS


EMERGENCY EXIT
COMPUTER TABLE
PRINTER
FOLDING SHELF
CUSHIONS
FOLDING SHELF
1.
TYPEWRITER TABLE
TABLE
2.
ROCKING CHAIR
SHELVES
CUSHIONS
CUSHIONS
PUPPET THEATRE
SHELVES
SHELVES
SHELVES
TABLE
SHELVES WITH CUPBOARDS
POTENTIAL UNIT
SHELVES WITH CUPBOARDS
SHELVES
SHELVES WITH CUPBOARDS + SINK
FOLDING SHELVES
COLLAGE TABLE
4.
TABLE
TABLE
3.
THEME TABLE
EASEL
EASEL
WATER TABLE
SAND TABLE
WOOD WORKING BENCH
SHELVES
SHELVES
STOVE + SINK SHELF
SHELVES
SINK
SHELVES UNIT & SINK
POTENTIAL UNIT
ROCKING BOAT
CLIMBER AND SLIDE
IRONING BOARD
5.
TABLE
6.
ROCKING CHAIR
CRADLE
SHELVES
CLOTHES RACK
SHELVES WITH CUPBOARDS
PLAY HOUSE
SHELVES FOR HOLLOW BLOCKS
BALL AND TARGET TOSS AREA
SHELVES WITH CUPBOARDS
MAIN ENTRANCE

1. TECHNOLOGY CENTER
2. QUIET / CONCEPTS CENTE
3. SCIENCE / DISCOVERY CENTER
4. CREATIVE ARTS CENTER
5. DAILY LIVING CENTER
6. ACTIVE ROLE PLAY CENTER

SCALE: 1 : 50 cm
S. Langen, 1990.

APPENDIX L

SOFTWARE EVALUATION FORMS

SOFTWARE EVALUATION FORM

Reviewer's Name: ____________________ Date of review: __________

Program Title: ____________________ Medium: 5" disk ____
3" disk ____
Other ______

Package Title: ____________________

Copyright date: ____________________

Microcomputer (brand, model, memory) ____________________

Necessary Hardware: ____________________ Necessary software ______

Producer: ____________________ Authors: ____________________

Backup Copy Policy ____________________ Cost: ____________________

Age level range ____ Grade level range ____ Remedial or enrichment level range ______

Type of Program: drill and practice _____ language ____

simulation _____ game _____ game type _______

OBJECTIVES:

Are objectives of the program stated in the Manual? Yes___ No___

Are the objectives related to familiar developmental tasks for young children? Yes___ No___

Are the objectives achieved by the software? Yes___ No___

Are the objectives related to curriculum goals? Yes___ No___

EDUCATIONAL CONTENT:

Is the content suitable for young children? Yes___ No___

Is the content interesting for young children? Yes___ No___

Does the content convey suitable values? Yes___ No___

Is the content accurate? Yes___ No___

Is the content free of racial and sexual bias? Yes___ No___

PEDAGOGY:

Is feedback to the children appropriate? Yes___ No___

Are the assumptions about children's learning appropriate? Yes___ No___

Do cues and prompts help children use the software correctly? Yes___ No___

Can children use the package without teacher intervention? Yes___ No___

Does it provide for two or more children working together? Yes___ No___

Is the content well-sequenced and well-paced? Yes___ No___

Can the children control the sequence and pace of the program? Yes___ No___

PRESENTATION:

Is the program free of technical problems? (bugs) Yes___ No___

Are directions in the program clear? Yes___ No___

Does it make good use of graphics? Yes___ No___

Does it make good use of sound? Yes___ No___

Are screen displays effective and attractive? Yes___ No___

Are error corrections meaningful and appropriate for children? Yes___ No___

Is teacher documentation clear and adequate? (e.g. Manuals clear, etc.) Yes___ No___

Is the frame display clear and easy to understand? Yes___ No___

Can the teacher modify the program? Yes___ No___

EVALUATION:

Is this a worthwhile use of computer resources? Yes___ No___

Recommend consideration of other resources? Yes___ No___

Recommend acceptance/purchase? Yes___ No___

SOFTWARE EVALUATION FORM

(Assign a score of 1 - 10 (1=poor, 10=excellent); insert score in each box beside each criterion. Total scores in all 10 boxes for a total out of 100.)

TITLE OF PACKAGE:

COMPANY:

ADDRESS:

PHONE:

PRICE:

DESCRIPTION:

AGE RANGE:

REQUIREMENTS:

Memory
Models
Graphics card

PRESENTATION

- color
- sound
- graphics
- format/mechanics (what does the child have to do? read?)

DEVELOPMENTAL REVIEW

- Interest
- Feedback
- Documentation
- Appropriate Stimulation
- Progression
- Variety

SCORE

APPENDIX M

MODULE TEST

COMPUTERS IN EARLY CHILDHOOD EDUCATION MODULE

Test

Circle the one correct response.

1. All the physical parts of a computer including the connections are referred to as:

    a) software
    b) input devices
    c) hardware
    d) the central processing unit
    e) the microprocessor.

2. Devices that work in combination with a computer but are not physically part of the computer are called:

    a) peripherals
    b) application software
    c) disk drives
    d) the CPU
    e) typewriter.

3. The step-by-step instructions (program) that tell a computer what to do are referred to as:

    a) bits and bytes
    b) ROM
    c) systems
    d) software
    e) data processing.

4. A system that, in addition to its other functions, controls the operation of a disk drive, the reading of information from and writing of information to the disks, and the management of the file structure of the disks is called:

    a) the cursor
    b) the disk operating system
    c) the central processing system
    d) artificial intelligence
    e) the database.

5. To enter a program into the memory of the computer from a peripheral storage device or a keyboard is to:

    a) monitor the program
    b) program the computer
    c) log-in the program
    d) debug the program
    e) load the program.

6. A modem is a device which permits a user to do the following:

a) save a file on a diskette
b) retrieve information stored on a diskette
c) print characters on paper
d) read the software
e) communicate between computers over phone lines.

7. Persons who have acquired a general range of skills and understanding needed to function effectively in a society increasingly dependent on computer and information technology are referred to as:

a) computer junkies
b) networkers
c) systems analysts
d) computer literate
e) smart terminals.

8. The use of computer applications to enhance instructional strategies employed in teaching a course is called:

a) information processing
b) data processing
c) computer-assisted instruction
d) courseware
e) downloading.

9. The position indicator on a video display screen that can be moved in various directions is called the:

a) cursor
b) compiler
c) bit
d) chip
e) mouse.

10. The video display unit is commonly referred to as a:

a) modem
b) monitor
c) menu
d) television
e) circuit card.

11. The use of a computer for purposes of recording and editing text is called:

a) microprocessing
b) documentation
c) saving and filing
d) word processing
e) data processing.

12. Floppy disks differ from hard disks in that:

    a) one has a much larger storage capacity than the other
    b) one is 3.50 inches wide, the other 5.25 inches wide
    c) one is a peripheral device, the other is an input device
    d) one is double-sided, the other is single-sided
    e) one produces softcopies, the other produces hardcopies.

13. When purchasing software for use by children, one has to ensure that:

    a) the package contains a backup copy
    b) the software is compatible with the hardware one is using
    c) the manual contains instructions for copying the diskette
    d) the software is indestructible
    e) the diskette has been formatted.

14. When purchasing hardware for use by children in an early childhood education program it is important to ensure that the system has built-in:

    a) graphics capability
    b) storage capacity
    c) read-only memory
    d) artificial intelligence
    e) debugging capacity.

15. The developmentally-appropriate use of computers by young children is promoted by:

    a) providing a computer lab with several computers which children can visit as a group a few times a week
    b) ensuring that one child at a time uses the computer
    c) encouraging children to use the computer in pairs and to collaborate
    d) letting children play on the computer as a reward after all their other work is complete
    e) the teacher working with each child on a one-to-one basis at the computer.

16. Software which poses questions for children which they must answer correctly in order to obtain feedback is called:

    a) simulation software
    b) open-ended software
    c) educational games
    d) drill and practice software
    e) developmental software.

17. When locating computers in the early childhood classroom it is best to put them:

    a) side by side
    b) each in a different learning centre
    c) close together and at right angles to one another
    d) near the sand and water tables
    e) in a secluded area apart from other learning centres.

18. An important issue which is still unresolved in the context of computer use with young children is:

    a) doubt surrounding the computer's value as another tool for learning
    b) whether or not computers create undue eyestrain
    c) whether or not children have the skills needed to use educational software effectively
    d) concern related to pushing children to learn academic skills too early
    e) whether computers inhibit social interaction and cooperation amongst children.

19. The rationale for the increasing use of computers by early childhood educators in programs for children is generally based on the assumption that:

    a) young children need to learn about computers in order to use them efficiently when they start grade one
    b) computers teach concepts more effectively and faster than they would learn them through play with concrete objects
    c) computers are an important part of our society which children must be exposed to in order be successful
    d) computers can replace former dependence on toys and materials which take more space and time
    e) computers can permit transfer of learning and reinforce the learning that occurs when children play with concrete objects.

20. The best way to prepare children to use computers is to:

    a) show them posters which show the computer and its component parts
    b) teach them computer literacy skills
    c) teach them basic programming skills
    d) set a few clear rules then let them use the computer
    e) teach children to type.

21. Rebus picture directions are:

    a) illustrations in the manual of typical software screen displays
    b) directions with picture clues that nonreaders can interpret and follow

c) printed words used to describe the pictures on a screen display
d) directions which describe the steps to follow in making an image reappear on the screen
e) instructions for rewinding the diskette.

22. The rate at which new software can be introduced to children depends on:

a) the children's level of computer skill
b) the difficulty of the program(s) introduced
c) the similarity of the new programs to each other and to the old programs
d) all of the above
e) none of the above.

23. When children are able to use the computer independently, the role of the teacher is to:

a) observe how children use the material
b) stop to enjoy the child's work and perhaps sit with the child for a while
c) ask open-ended questions when appropriate
d) provide help if the child has a problem
e) all of the above.

24. The developmental appropriateness of software for children can be determined by examining:

a) whether or not it challenges children to practise age-appropriate developmental skills
b) the description of the software on the packaging
c) the manual instructions
d) the quality of the graphics displays
e) whether or not it provides positive feedback when children find the right answer.

25. Children learn about computers most efficiently when:

a) teachers teach them a formal course about computers
b) they go on field trips to places where computers are used
c) they begin to interact with computers and gain physical knowledge of them
d) teachers demonstrate the use of computers
e) they have learned to read.

26. The most effective way to integrate computer-based learning into the regular classroom is to:

a) take children to the school or child care centre computer lab two or three times a week to use the computers under supervision
b) teach children how to program using LOGO

- c) encourage children to use the computer after they have completed their other work
- d) let children experiment with turtle graphics
- e) provide developmental software in technology centre which facilitates transfer of learning achieved with concrete play materials.

27. Functional knowledge of computers is:

- a) essential to using computers for learning purposes
- b) necessary before one gains operational knowledge
- c) the ability to know how to turn the system on and off
- d) useful instead of having to rely exclusively on memory of correct procedures to follow
- e) knowing the many ways in which computers are used in our society.

28. Children gain functional knowledge of computers primarily by:

- a) using them
- b) taking computer literacy courses
- c) learning how to follow the commands for the program being used
- d) learning the names and functions of all the components of computers
- e) using a variety of different kinds of software.

29. Natalie is continually disappointed because she loses the drawings she creates on the screen, sometimes even before she manages to print them out. Natalie's teacher frequently reminds her to save her work and has shown her how to do so. This child's frustration can probably be attributed largely to:

- a) lack of operational knowledge
- b) lack of functional knowledge
- c) developmental delay
- d) poor memory
- e) lack of space for storing drawings.

30. A particular software package for preschool children provides graphic displays of groups of similar objects in a series with one item in the series missing. Children have to choose from a row of miscellaneous objects at the bottom of the screen the object which will fit the missing slot for each series. This software activity is addressing the following developmental skill:

- a) seriation
- b) conservation
- c) classification
- d) matching
- e) visual discrimination.

31. Children have been encouraged to practise ocular motor skills in the psychomotor program and in Creative Arts centre. In the gymnasium, they have been playing catch with large rubber balls; in art area they have been creating a large poster representing springtime. In order to promote transfer of this learning, the teacher has selected a software package which will address similar skills at the computer in the technology centre. The graphics displays in the software program include the following type of task:

    a) groups of multicolored objects which must be sorted according to color
    b) as the child presses the arrow keys, a large happy face moves across the screen, chases chocolate chip cookies on the screen and gobbles them up as it catches them
    c) large multicolored shapes composed of smaller shapes each of a different color can be rearranged by children using the keyboard to create different shapes
    d) children must supply the missing number in a series of numbers which flash on the screen
    e) complex line illustrations of scenes flash on the screen one by one; the child must select from a series of object pictures at the bottom of the screen, which object can be found embedded in the line illustration.

32. Computer games which provide for use of a joystick to control movements of a target on a screen address:

    a) task orientation skills
    b) visual discrimination
    c) eye-hand coordination
    d) object constancy
    e) manipulative abilities.

33. When using a printer, the child must learn:

    a) how to get the printer to print
    b) how to advance the paper
    c) how to remove the paper
    d) all of the above
    e) none of the above.

34. When purchasing software for children, it is important that teachers:

    a) rely on promotional literature produced by publishers
    b) purchase what they find for the age group of children they teach
    c) review the software that interests them in a systematic way
    d) let children choose software from the catalogues
    e) find a publishing company they like and purchase whatever that company produces.

35. Open-ended software for children promotes:

    a) creative thinking
    b) problem-solving
    c) independent control over the computer
    d) all of the above
    e) none of the above.

36. Children's conceptions of the computer depend on:

    a) their levels of computer literacy
    b) what they are encouraged to do with it
    c) how well the teachers explain what computers can do
    d) whether or not they have a computer at home
    e) the age at which they begin to work with computers.

37. Children who want to play at the computer for long periods at a time should be encouraged to play in other learning centers because:

    a) little is known about the effect on the eyes of long periods of computer use
    b) computers should never replace children's active experience with concrete objects in the environment
    c) manipulating images on a screen is inferior as a form of play to manipulating three-dimensional objects
    d) all of the above
    e) none of the above.

38. Before introducing a computer into the early childhood classroom teachers should:

    a) be experts in the use of computers themselves
    b) ensure that children will have an opportunity to practise their computer skills at home
    c) know what they want the computer to do and how it should be used in the regular program
    d) acquire a large and varied collection of software
    e) learn programming skills and create their own software.

FOR EACH OF THE TWO FOLLOWING QUESTIONS ONLY, CHOOSE THE ONE INCORRECT RESPONSE.

39. When creating a software collection:

a) build a collection of kits that complement one another
b) acquire kits that can be expanded to serve several levels of development and computer skill
c) find kits that promote a variety of developmental skills
d) include kits that allow children to explore the computer's various uses
e) be careful to choose software which provides clear directions and controls the child's actions and behaviors as s(he) works on the tasks.

40. Teachers experienced in the use of computers in early childhood programs recommend having two computers in the preschool classroom because:

a) having more than one computer offers children an opportunity to compare notes between computers
b) having one computer for every ten children is optimal
c) two computers encourage positive social and cognitive interactions at the computer
d) the more computers there are in the room, the more positive and useful their contribution will be to learning
e) having two computers reduces the time a child must wait to use the computer.

APPENDIX N

MODULE EVALUATION FORM

ECE COMPUTER MODULE EVALUATION

Part I

1. To what extent did this computer module meet your own objectives/expectations?

poor fair satisfactory good excellent

2. To what extent did the computer module meet the objectives stated in the module outline?

poor fair satisfactory good excellent

3. How would you rate the Davidson textbook in terms of whether or not it addressed the module objectives and topics covered in the Module?

poor fair satisfactory good excellent

4. To what extent did the module convince you of the educational benefits for children to be derived from the introduction of computers into the early learning environment?

poor fair satisfactory good excellent

5. To what extent has the module helped to allay reservations you may have had about the potential negative impact computer use may have on young children developmentally?

poor fair satisfactory good excellent

6. To what extent was the computer module a positive learning experience for you?

poor fair satisfactory good excellent

7. To what extent did the computer module address to your satisfaction the central issues involving computers in early childhood education facing teachers today?

poor fair satisfactory good excellent

8. To what extent was the computer laboratory facility we used a satisfactory learning environment for this module?

poor fair satisfactory good excellent

9. To what extent do you believe that computers are useful learning tools which can enhance children's learning experiences in the concrete world?

poor fair satisfactory good excellent

10. At the conclusion of this module, how would you describe your skills in terms of your ability to introduce computer(s) into a program for young children (assuming that you will gain further experience along with the children)?

poor fair satisfactory good excellent

Part II

1. If you were already experienced in the use of computers as word processors, data processors, or for computer games, did you still manage to learn something new in this module?

   Yes____ No_____ NA_____

   Comments:

2. Do you believe that students would benefit from more hands-on learning time in the computer lab?

   Yes____ No_____ NA_____

   If yes, please indicate the number of additional hours you would recommend in hands-on learning? _____ hours.

3. Should extra hands-on learning time be spent on: (number 1-2-3-4) in order of priority)

   software evaluation ____
   word processing skills ____
   MS-DOS tutor ____
   administrative applications ____

4. Would you prefer to have a computer expert teach this module on the understanding that that person would also have to understand the developmentally-appropriate uses of computers in early childhood education?

Yes ____ No ____ No opinion ____

Comments:

5. What topics would you like to see added to the module on computers in ECE?

6. Do you recommend that this module become a permanent component in the ECE Program?

Yes ____ No ____ No opinion ____

Comments:

7. Do you have any recommendations for changes/additions to the computer laboratory facility?

Yes ____ No ____ No opinion ____

If yes, please specify:

8. Will you recommend that computer(s) be introduced into the program for young children in which you will be working next year?

Yes ____ No____ No opinion____

Please record below any additional comments/feedback you wish to provide. Thank you for completing this evaluation.

Dale Shipley, 1990.

APPENDIX 0

ARTICLE IN ALGONQUIN COMPUTES

What's ECE Doing in a Place Like This !

Introducing new module takes grit and the spirit to risk.

By Dale Shipley, Family Studies
Colonel By

Maybe there is some truth to that old saying "if you can't do it, teach it!" I have just completed a module of computer education for Early Childhood Education students which has been a triumph of nerve over know-how.

Once I was greeted in the lab by a colleague with, "ECE? What are you doing here?" I wasn't sure whether I should respond or beat a humble retreat. It takes grit to persevere in a land of "literate" people.

There comes a moment when external pressures mount to the point that one can no longer ignore the fact that graduates must be at least acquainted with the world of computer technology, if not computer literate.

Our graduates in Early Childhood Education need to be able to argue intelligently about the integration of computers into preschool and kindergarten programs. There are growing expectations that preschool programs should provide computers as additional tools for play and learning in the classroom.

Only two students computer literate at the start

My purpose was to develop a module which would break down the barriers many students perceive between computers and themselves, raise questions and issues related to the use of computers in programs for young children, inform students about using computers with children in developmentally-appropriate ways, and provide opportunities to evaluate educational software.

Many of the students had never used a computer; some had played video games; others were using word processors. Only two of the twenty-four students were computer literate at the beginning of the module. A majority of the students expressed reservations about the usefulness and appropriateness of computers in early childhood education but nearly all of them wanted to know more and to understand the issues a little better.

My own computer skills extended only as far as a course on WordPerfect and, since then, daily use of my computer as a word processor. To undertake this module, I had to muster as many resources and as much of a risk-taking spirit as I could find out there and within myself.

Students survey hardware, software

I started the module gently, with an assignment which required students to research the specifications of three types of computer systems and at least two different sales centres. Students needed to acquire information about hardware such as memory, graphics capability, peripherals, costs, warranties - the usual "basics". They also had to locate and describe some compatible children's educational software for each system.

I emphasized that there are many computer sales centres across the Region which they could consult as if they were actually purchasing a system. Unfortunately, I happened to mention in class one day the name of a downtown sales centre where salespersons were particularly helpful to teachers. Soon I found myself apologizing to the manager for the fact that my students were descending en masse upon him and his good-natured salespeople.

Nonetheless, that assignment and Rose Anne Leonard's Computer Literacy Treasure Hunt provided a practical introduction to hardware, software and the mystifying computer market that saved many hours of class time.

One student actually purchased a computer.

Lab for hands-on work only

It was a few weeks before the students and I had sufficient knowledge to make full use of the lab time which I had reserved. I had been wise to book only as much time as students would need for hands-on practice. When we actually began our work in the lab, the students were eager to apply the knowledge they had gained in the classroom.

My objectives for the lab component were to have the students evaluate educational software for children according to specific developmental criteria. They worked in pairs, with more experienced students helping the novices, emulating the methods they would use when introducing computers to young children.

In addition to the software evaluation requirement, they were introduced to WordPerfect 5.0 and Typing Tutor and had to format their own diskettes.

Someone formatted Gertrude's Secrets

There were some hair-raising moments in the lab when the software wouldn't load and when we discovered that someone had inadvertently formatted the diskette containing Gertrude's Secrets. There were frustrating times when I regretted having to make do with systems without graphics cards and with monochrome instead of colour monitors.

I had a little flash of insight when I overheard a student say, "Don't ask Dale; she won't know. Figure it out yourself". The whole experience reinforced my commitment to the concept of teacher-as-facilitator as opposed to the teacher-expert model!

Everyone passed

The students wrote a test at the end of the module which demonstrated how much they had learned. They all passed.

Most students finished the module with some pretty definite ideas about how, whether and when to introduce computers to young children. They didn't all agree on the issues which were raised and discussed. They all acquired some skills needed to evaluate educational software.

Now and then it is stimulating and fun to learn along with the students. Sometimes, one just has to take the plunge....

APPENDIX P

LETTER FOR STUDENTS WHO COMPLETE MODULE

May, 1990.

To Whom It May Concern,

____________________________ has successfully completed a 26-hour Computers in Early Childhood Education Module which has been included in the courses Early Childhood Education II, III and IV. The main focus of the Module has been the selection of developmentally-appropriate software for young children, choosing and purchasing hardware including peripherals and integration of computers into the early childhood classroom and the regular curriculum. The intent of this new training venture has been to instruct and provide experience to students in the appropriate use of computers as another tool for play and learning within the early learning environment.

Yours sincerely,

Dale Shipley
Early Childhood Education Program
Algonquin College

APPENDIX Q

INVENTORY OF SOFTWARE FOR EARLY CHILDHOOD EDUCATION COMPUTER EDUCATION MODULE

INVENTORY OF SOFTWARE FOR EARLY CHILDHOOD EDUCATION

Note: This software was ordered for the Department of Family Studies by Dale Shipley for general use in Family Studies computer-based courses and specifically for the Module in Computer Education for ECE students. All the following software is designed for use on IBM-PC systems and compatibles.

KIDWRITER by Spinnaker ages 6 - 10 (writing skills)

JOSHUA'S READING MACHINE by CompuTeach ages 4 - 7 (early reading)

ONCE UPON A TIME by CompuTeach ages 6 - 12 (publish/design)

SHAPE AND COLOR RODEO by DLM preschool - K (shape & color)

HODGE PODGE by Artworx ages 3 - 6 (amusement, alphabet recognition)

ANIMAL HOTEL by Learning Technologies ages 4 - 8 (reading readiness)

MOTHER GOOSE by Sunstar Systems ages 4 - 6?

NUMBER FARM by DLM ages 4-7 (number concept)

SIGNPLAY by CompuTeach ages 4 - 5 (early reading, word recognition)

BIKE HIKE by Learning Technologies ages 4 - 8 (reading readiness)

FACEMAKER by Spinnaker ages 3-8 (learn about computers)

NEWSROOM PRO by Springboard all ages (publishing)

CLIP ART COLLECTION Volume 3 by Springboard

MUPPETS ON STAGE by Sunburst ages 4-8 (letters & numbers)

MUPPET LEARNING KEYS by Sunburst ages 4 - 8 (the keyboard)
KID'S COMPUTER KEYBOARD

MEMORY: A FIRST STEP by Sunburst ages K - 2

THE SUPER SIGN MAKER by Sunburst ages K - 2

SIR ISAAC NEWTON'S GAMES by Sunburst school-age (laws of motion)

CODE QUEST by Sunburst school-age (problem-solving)

THE POND by Sunburst school-age (problem-solving)

THE PUZZLER by Sunburst school-age (reading strategies - focus on comprehension)

GETTING READY TO READ AND ADD Sunburst school-age (early reading and adding)